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THE HIPPOBOSCIDAE OR LOUSE-FLIES (DIPTERA)
OF MAMMALS AND BIRDS
PART II. TAXONOMY, EVOLUTION
AND REVISION OF AMERICAN GENERA AND SPECIES

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(Continued from volume XXXIV)

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Stilbometopa Coquillett, 1899

- Stilbometopa* Coquillett, 1899, *Canad. Entom.*, **31**, p. 336 (monotypic for *Ornithomyia fulvifrons* Walker, 1849).
Stilbametopa Lutz, Neiva and da Costa Lima, 1915, *Mem. Inst. Osw. Cruz*, **7**, p. 193 (error for *Stilbometopa*, in the combination *Stilbametopa impressa*).
Stilpometopa Guimarães, 1944, *Papeis Avulsos Depto. Zool. São Paulo*, **4**, No. 5, p. 82 (error for *Stilbometopa*, in the combination *Stilpometopa ramphastonis*).
Stribbometopa Lizerand, 1953, *Maladies du Gibier à Plumes* (Paris), p. 94 (error for *Stilbometopa*, in the combination *Stribbometopa podopostyla*).

Generic Characters. Permanently and fully winged parasites of birds, not metallic-greenish, but sometimes with dull-green pigment in the haemolymph. Head large, transversely elliptical, inserted in the deeply concave anterior margin of prescutum. Ocelli absent. Eyes large, with minute, ill-defined facets. Postvertex larger than usual, smooth, sometimes anteriorly with a superficial pit or notch; occipital margin overlapping anterior margin of prescutum, with a distinct median, inward curve and separated from the long upper orbits by shallow sinuosities; mediovertex relatively short and narrow, as long as or slightly shorter than postvertex; inner orbits very broad. Frons (Fig. 47D) divided by a transverse suture into a broad upper lunula and a narrow interantennal portion; lunula as long as postvertex, with a median longitudinal impressed line ending in a pit at the ptilinal suture; interantennal portion divided almost to the base into two long, parallel, flattened arms, placed close together, slanting under the inner margins of the antennae, the apical tips broadly rounded and slightly diverging; integument of apical arms thick and hardened over basal half only, remainder (partly covered by antennae) thin, weakly sclerotized, flexible and translucent. Palpi short, extending little or not beyond antennal appendages. Antenna: 1st segment divided superficially or incompletely by a depression or fine suture from the side of lunula; appendage of 2nd long, broad, flattened, leaf-like, narrowed into a point; arista racket-shaped, the stalk abruptly widened at apex into a thin, elliptical plate, supported by a median thickening or rod giving off a few side riblets to the margins, the plate appearing pennate. Pronotum very short, not visible from above. Humeral callosity large, separated from anepisternum by an incomplete, superficial or rudimentary suture, extended forward as a long, bluntly triangular lobe; posthumeral suture deep over lateral third of prescutum, then superficial or obsolete toward anterior margin; prothoracic spiracle large, dorsal, placed far from side margin and from posthumeral sutures. Deeply concave an-

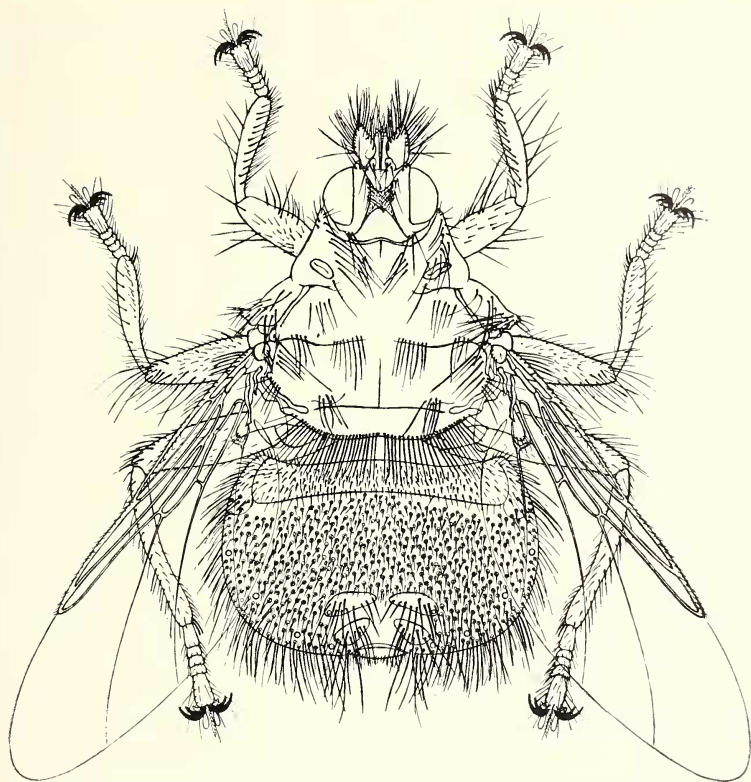


Fig. 45. *Stilbometopa impressa* (Bigot), ♀, Bitterwater, on *Lophortyx c. californica*. $\times$ about 8.

terior margin of prescutum slightly convex medially and somewhat raised to fit the inward curve of occipital margin; transverse mesonotal suture slightly behind mid-length of mesonotum, deep and nearly straight or slightly wavy laterally, broadly interrupted medially; anterior ridge of parascutellum fused with mesoscutum; median notal suture a superficial, very fine impressed line, often incomplete or mostly vestigial; notopleuron very narrow, as a rule divided from prescutum only anteriorly and fused with it posteriorly, but sometimes separated completely by a suture. Dorsal anepisternum broad, nearly parallel-sided, its outer, preälar edge more or less produced, the shape of the edge characteristic for each species. Scutellum broad, short, transversely semi-elliptical; hind margin with a sharp edge, straight or with a very slight median, inward curve and evenly rounded at the slanting sides; surface flat,

with a slight median, longitudinal depression triangularly widened behind; scuto-scutellar suture deep, continuous, straight or slightly wavy. Metathoracic pleurotergite prominent, moderately swollen basally, apically with a strong, anvil-shaped process. Sternum: pro-mesonotal suture indistinct or lacking; prosternum forming two broad, triangular, rounded or bluntly pointed, flattened intercoxal lobes separated by a wide notch continued behind as a deep median pit; mesosternum raised on each side as a blunt, transverse ridge before mid coxa, forming a low tubercle in *S. ramphastonis* and *S. legtersi*; meso-metasternal suture fairly distinct or weak, broadly V-shaped (with blunt forward angle ending in a furcal pit); basisternum and furcasternum of metathorax fused, their limit marked only by a deep, wide, median furcal depression; meta-basisternum produced behind on each side as a flat, retrograde tooth (*metasternal spur*) which overlaps the base of hind coxa. Metathoracic spiracle placed as in *Ornithoetona*. Legs long, robust; femora much swollen; tibiae broad, flattened; tarsal segments 1 to 4 very broad and short; hind basitarsus moderately lengthened, without transverse comb of setae beneath; tips of all tibiae normal; 2 apical spurs on all tibiae, often hidden in the adjoining bristles. Claw proper (Fig. 47*G*) deeply bifid, the two teeth nearly the same width, but the outer one longer and sharper; basal "heel" sharp, shorter than inner tooth. Wing large, with the complete venation for the family (Figs. 46*A-E*): 3 cross-veins, placed much as in *Ornithoetona*; subcosta complete, ending in costa close to tip of 1st longitudinal; axillary cell with a rudimentary axillary vein; 6th longitudinal broken up along hind margin of anal cell (Fig. 47*C*): basal portion thickened, ending abruptly and with a sharp inner edge connected with a lightly sclerotized area of the cell membrane, apical portion very narrow, pale, ending in a point; costa setulose; other veins bare; membrane bare throughout; alula very large; both calypteres much reduced, rudimentary. Abdomen: dorsally, behind the more or less fused basal pleurotergites, with 2 pairs of preanal sclerites in both sexes; median dorsal area without sclerites, membranous, not striate; ventrally, ♂ with a pair of flattened sclerites basad of terminalia and ♀ with a pair of elongate pregenital sclerites. Seven pairs of abdominal spiracles: 1st in side edge of the very short 1st pleurotergite; 2nd ventrally, some distance from sides of 2nd pleurotergite; 3rd to 7th latero-dorsally (on expanded abdomen), the 6th in or close to outer edge of 1st preanal sclerite, the 7th close to outer edge of 2nd preanal sclerite and some distance from anal opening. Integument of the very depressed head and thorax unusually smooth

and slippery, shiny, mostly bare; most setae reclining backward, except on antennae. On head and thorax some setae strong and black, others weak and pale; orbital bristles few, mostly in one irregular row, widely separated from a few bristles placed near lower frontal suture; antennal appendage, oral margin beneath and postgenae with long setae; 1 to 4 vertical bristles on each side near postvertex; disk of mesonotum bare except for small patches or short rows of long, appressed setae; 1 to 3 notopleural bristles; humeral callosity and anepisternum moderately setulose; disk of scutellum bare, but hind edge with a conspicuous, regular, dense, comb-like row of 40 to 46 long, stiff, recumbent bristles (the nearest approach to a ctenidium in the Hippoboscidae); metathoracic pleurotergal process with some short setae at both tips; no hypopleural bristles. Abdomen densely and fairly uniformly covered with short setae on small knobs; a few longer bristles apically and on tergal sclerites. Male terminalia (Fig. 47*E*) of the simplest type found in Hippoboscidae, reduced to aedeagus (penis and 2 penis valves); no trace of gonocoxites.

Stilbometopa possesses several unusual features, such as the peculiar interantennal frons, the trisinate occipital margin, the extreme dorsal position of the prothoracic spiracles, the transverse scutellum with the conspicuous apical comb of bristles, the anvil-shaped metathoracic pleurotergites, the prominent metasternal spurs, the interrupted lower margin of the anal cell, the racket-shaped antennal arista, and the lack of gonocoxites in the male terminalia. The partial disappearance of the suture between notopleuron and prescutum in most species and the fusion of some of the sternal areas of the thorax in this genus help to understand the more complete loss of the thoracic sutures in some other Hippoboscidae.

Stilbometopa is a strictly American and mainly tropical and subtropical genus of 5 closely related species. The characters separating them are of degree only and often difficult to appreciate, so that the species are far from being completely elucidated. Of the 3 reported from temperate North America one (*S. impressa*) is known only from the western United States, another (*S. podopostyla*) perhaps occurs there only during the summer, and the third (*S. fulvifrons*) is clearly accidental.

The subjoined key supersedes one published some years ago (J. Bequaert, 1935*b*, pp. 323-324), which used other characters now regarded as either unreliable or too subtle for ready identification, as discussed under the several species. In particular, I have found

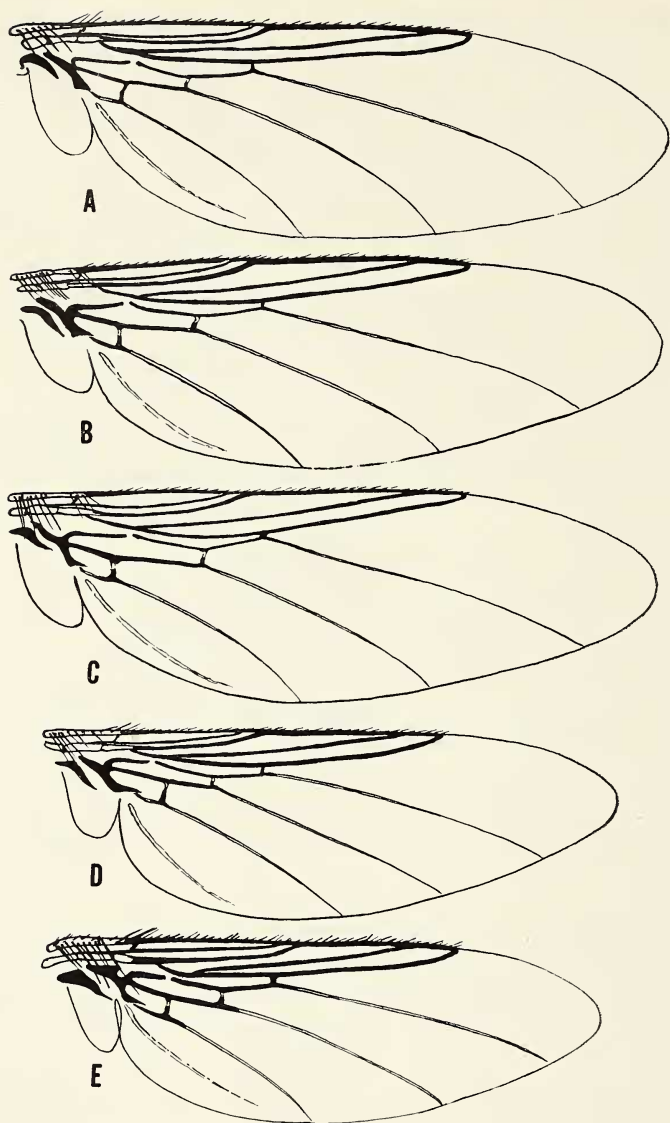


Fig. 46. Wings of *Stilbometopa*: **A**, *S. impressa* (Bigot), ♂, Bitterwater, on *Lophortyx c. californica*; **B**, *S. podopostyla* Speiser, ♀, Nova Teutonia, on *Tinamus solitarius*; **C**, *S. fulvifrons* (Walker), ♀, Baraguá; **D**, *S. ramphastonis* Ferris, ♀, Sto Thomas, Izabal, on *Ramphastos* sp.; **E**, *S. legtersi* J. Bequaert, ♀ holotype, Xocempich.

the shape of the metathoracic pleurotergal process too variable intraspecifically to be trusted; it depends also to some extent upon the angle at which it is viewed. The number of vertical bristles likewise is not reliable as a specific character.

Key to Species of *Stilbometopa*

1. Preälar apex of anepisternum seen from above broad and protuberant, obliquely truncate, with a prominent, blunt outer and a small inner angle (Fig. 50F). Metasternal spur reaching nearly mid-length of hind coxa. Inward curve of occipital margin broad and very shallow (Fig. 47F). Wing 8 to 9 mm. long *S. impressa*
 Preälar apex of anepisternum seen from above narrow, rounded off, not with a prominent outer angle 2
2. Preälar apex of anepisternum seen from above gradually narrowed into a blunt angle, not lobe-like nor set off by a depression (Figs. 50I-J). Notopleuron completely divided by a suture from prescutum. Metasternal spur reaching mid-length of hind coxae 3
 Preälar apex of anepisternum seen from above somewhat projecting, either lobe-like or set off by a slight depression (Figs. 50G-H). Notopleuron only partially divided by a suture from prescutum, fused with it posteriorly 4
3. Basal sternite of abdomen short, wider than long, with a few short setae at apical margin; basal tergite short, not deeply curved inward nor divided medially. Inward curve of occipital margin broad and very shallow (Fig. 49C). Wing 8.5 to 9 mm. long *S. ramphastonis*
 Basal sternite of abdomen longer than wide (somewhat shorter in ♂ than in ♀), bare; basal tergite long, deeply curved inward and divided to near base medially. Inward curve of occipital margin broad, but deep (Fig. 49D). Wing 6.5 to 7.5 mm. long *S. legtersi*
4. Metasternal spur short, not reaching mid-length of hind coxa (Fig. 48A). Preälar apex of anepisternum relatively narrow, slightly curved inward at the depressed and somewhat lobe-like tip (Fig. 50G). Inward curve of occipital margin deep and narrow (Fig. 49A). Wing 6.5 to 8 mm. long.
 *S. podopostyla*
 Metasternal spur long, reaching mid-length of hind coxa (Fig. 48C). Preälar apex of anepisternum relatively broad, evenly rounded off, not lobe-like (Fig. 50H). Inward curve

of occipital margin moderately deep and wide (Fig. 49*B*).
Wing 6.5 to 8 mm. long *S. fulvifrons*

Stilbometopa impressa (Bigot)

Figs. 45, 46*A*, 47*A-G*, and 50*B-F*

- Olfersia impressa* Bigot, 1885, Ann. Soc. Ent. France, (6), 5, p. 237 (no sex; no host. California. Type ♂ from Bigot Coll., now in J.E. Collin Coll.). Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 191 (copy of original description).
- Stilbometopa impressa* Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 163 (type; also another specimen from California). Aldrich, 1905, Smithson. Misc. Coll., 46, No. 1444, p. 655. Speiser, 1907, Ent. News, 18, p. 103; 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 303. Ferris and Cole, 1922, Parasitology, 14, pt. 2, p. 201, figs. 17 and 18*A-C* (♀. California: Mecca; Mt. Hamilton, on quail; San Diego; and without precise locality, on *Lophortyx c. californica*). Essig, 1926, Insects Western North America, p. 623. Falcoz, 1930, Encycl. Entom., Ser. B, Diptera, 5, (for 1929), p. 27 (♀. Arizona). Ferris, 1930, Canad. Entom., 62, p. 64, figs. 2*E* and 2*G* (fig. 2*E* referred to *S. ramphastonis* by error in caption, corrected in text. Arizona: Rincon Mts., on *Lophortyx g. gambelii*). O'Roke, 1930, Univ. California Publ. Zool., 36, pt. 1, p. 12; 1932, California Fish Game, 18, pt. 3, p. 230. Gorsuch, 1934, University of Arizona Bull., 5, pt. 4, p. 56 (Arizona: on *Lophortyx g. gambelii*). J. Bequaert, 1935, Rev. de Entomologia, 5, pp. 323 and 325, fig. 14. Herman and Glading, 1942, California Fish Game, 28, p. 150, fig. 45 (larger of 2 flies shown). Herman, 1944, J. of Parasitology, 30, pp. 112-118 (California: Orange Co.; Riverside Co.; San Benito Co.; O'Neals, Madera Co., on *Lophortyx c. californica*. Life history; puparium); 1945, California Fish Game, 31, p. 21, figs. 10*A* and 10*C* (puparium, adult). Herman and Bischoff, 1949, *Op. cit.*, 35, p. 295 (California: Dune Lakes area, San Luis Obispo Co., on *Lophortyx c. californica*. Transmission experiments with *Haemoproteus lophortyx*). Herms, 1950, Medical Entomology, 4th Ed., p. 414. Tarshis, 1952, Bull. Brooklyn Ent. Soc., 47, pp. 70 and 78 (adults from trapped *Lophortyx c. californica* in California). Knowlton, 1953, *Op. cit.*, 48, p. 19 (Nevada: Gord Springs, Lincoln Co., on "quail" [*Lophortyx g. gambelii*]). Furman and Tarshis, 1953, J. of Parasitology, 39, p. 70 (California: on *Lophortyx c. californica*; not found infested with mites). Campbell and Lee, 1953, Studies on Quail Malaria, New Mexico Dept. Fish Game, pp. 4, 17, 20, 21, 49, 50, 51, 52, 68, 69, and 78 (New Mexico: Las Cruces, Dona Ana Co., on *Lophortyx g. gambelii*; near Hot Springs, Sierra Co., on *Lophortyx g. gambelii*; Playas Lake, Hidalgo Co., on *Callipepla squamata pallida*; Isaac Ranch, Dona Ana Co., on quail; near Deming, Luna Co., on quail; Dona Ana, Dona Ana Co.; Anthony, Dona Ana Co. *L. gambelii* and *C. squamata* infected with *Haemoproteus lophortyx*); 1953, Completion Report, New Mexico Project W-41-R, (mimeographed), p. 3. Tarshis, 1953, Science, 118, pp. 199-202, figs. 1-8 (oöcyst-like bodies on midgut); 1953, Summary of Dissertation, Berkeley, California, p. 1; 1954, Psyche, 61, p. 58 (technique); 1955, Experimental Parasitology, 4, No. 5, pp. 464-492, figs. 2 and 9 (digestive and salivary system; transmission of *Haemoproteus lophortyx* to *Lophortyx c. californica*).
- Stilbometopa impressa* Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 193 (copy of Speiser's redescription).
- Stilbometopa expressa* Schuurmans Stekhoven, Silva and San Ramon, 1954, Zeitschr. f. Parasitenk., 16, p. 395 (error for *impressa*).

Distribution and Specimens Examined. UNITED STATES. ARIZONA (recorded by Falcoz, 1930; Ferris, 1930; Gorsuch, 1934): without precise locality from southern Arizona; Flagstaff, Coconino Co.; near Diamond Joe Mine, between Hickenburg and Morristown, Maricopa Co., on *Lophortyx g. gambelii*, Dec. 6 (W.H. Henry); 3 miles S. of Round Valley, Big Sandy Valley, Mohave Co., on *Lophortyx g. gambelii* (A.R. Phillips); Phoenix, Maricopa Co., on *Lophortyx g. gambelii* (A.K. Fisher; C. Stannard); Baboquivari Mts., Pima Co. (W. Benedict); Globe, Gila Co., on *Lophortyx g. gambelii* (D.K. Duncan); Oracle Junction, Pinal Co., on *Lophortyx g. gambelii*, Nov. 5 (H. Keller); Ehrenburg, Yuma Co. (F.H. Parker); Oracle, Pinal Co., on *Lophortyx g. gambelii*, Nov. 15 (G.R. Hungerford); Duncan, Greenlee Co., on domestic chicken (Rowe); Vail, Pima Co., Oct. 28 (C. Beach); Clemenceau, Yavapai Co., on *Lophortyx g. gambelii* (M. Pearce); Rincon Mts., Pima Co., on *Lophortyx g. gambelii* (A.A. Nichols).—CALIFORNIA (recorded by Bigot, 1885; Speiser, 1902; Ferris and Cole, 1922; O'Roke, 1930; Herman, 1944; Herman and Bischoff, 1949; Tarshis, 1952; Furman and Tarshis, 1953): Tehama Co., on *Lophortyx c. californica* (L.V. Compton); Stoneyford, Glenn Co., on *Lophortyx c. californica*; Chiles Ranch, Chiles Valley, Napa Co., on *Lophortyx c. californica*, June 30 to Nov. 16 (I.B. Tarshis); Mt. Hamilton, Sa. Clara Co., on *Lophortyx c. californica*; Watsonville, Sa. Cruz Co., on *Lophortyx californica brunnescens* (I.B. Tarshis); Jolon, Hunter Liggett Military Reservation, Monterey Co., on *Lophortyx c. californica*, Sept. 20 to Jan. 1 (C.V. Duff); Bitterwater, 15 miles S.E. of King City, San Benito Co., on *Lophortyx c. californica* (I. B. Tarshis); Dunes Lakes near Santa Maria, San Luis Obispo Co., on *Lophortyx c. californica* (C. M. Herman); 15 miles S.W. of Sonora, Tuolumne Co., on *Lophortyx c. californica*; Shandon, San Luis Obispo Co., on *Lophortyx c. californica* (I.B. Tarshis and I. McMillan); Cedar Canyon, Cook Spring, Kern Co., on *Lophortyx c. californica* (I.B. Tarshis); Bakersfield, Kern Co., on *Lophortyx c. californica*, Jan. 1 (B.L. Fox); Ventura Co. (D.W. Coquillett); Mohave Desert, San Bernardino Co., on *Accipiter cooperii* (F.W. Hein); Mecca, Riverside Co. (D. Kiler); Upper Palm Canyon, San Jacinto Mts., 3,000 ft., Riverside Co., on *Lophortyx c. californica* (F. Grinnell, Jr.); Hemet, Riverside Co., on *Oreortyx p. picta*; Poway, San Diego Co. (W.W. Baker); other published records also from Orange Co. and Madera Co.—NEVADA (recorded by Knowlton, 1953): Gord Springs, Lincoln Co., on *Lophortyx g. gambelii*, Dec. 12 (W.B. Low).—NEW MEXICO (recorded by Campbell and Lee, 1953, from Sierra Co. on *L. g. gam-*

belii, Luna Co. on quail, and Hidalgo Co. on *Callipepla squamata pallida*: Las Cruces, Dona Ana Co. on *Lophortyx g. gambelii* (C.D. Lebert).

Mexico: near Granados, State Sonora, 1 ♀ on *Lophortyx douglasii bensoni*, Aug. 10, 1954 (A.R. Phillips).

S. impressa is known at present from the western United States, in California, Nevada, Arizona and New Mexico, and from north-western Mexico, in Sonora. No doubt its actual range is more extensive and probably covers at least that of the genus *Lophortyx*. The northmost record is from Tehama Co., in about 40° N., and the southmost from Sonora, in 30° N. Although often found with *Lynchia hirsuta*, sometimes on the same individual bird, its distribution is possibly more southern on the whole. It is not known from Idaho, where *L. hirsuta* occurs, but has been taken in Arizona, New Mexico and Sonora, where *L. hirsuta* is unknown.

Known hosts of *S. impressa* (verified individual records in parentheses). Falconiformes (1): *Accipiter cooperii* (1). Galliformes (26): *Callipepla squamata pallida*; **Gallus gallus bankiva* (1); *Lophortyx c. californica* (12); *L. californica brunnescens* (1); *L. douglasii bensoni* (1); *L. g. gambelii* (10); *Oreortyx p. picta* (1).

Bionomics. The host relations and population dynamics of *S. impressa*, briefly mentioned in Part I (pp. 318 and 232), will be discussed fully by Dr. I.B. Tarshis in a forthcoming publication. This fly is a very common parasite of California quail, *Lophortyx californica*, the listed records giving only an incomplete idea of its frequency. According to C.R. Hungerford (*in litt.*), it is equally abundant on Gambel's quail, *L. gambelii*, in Arizona, where in November, 1952, at Oracle, he found some 50 per cent of the birds infested, with up to 3 flies per bird. Only *L. californica* and *L. gambelii* are definitely known as breeding hosts. The 2 flies found on *Oreortyx picta* in the same locality, September 27 and October 1, 1948, seem to have been accidental occurrences or were perhaps due to live contamination in traps. Campbell and Lee (1953) mention that *S. impressa* was once taken in Hidalgo Co., New Mexico, on scaly quail, *Callipepla squamata pallida*, possibly as a stray. Dr. Herman obtained some specimens also from introduced chukar partridge, *Alectoris graeca*, kept in captivity in California close to California quail. *S. impressa* has been taken on the host in California from June to the end of December; what happens to it during the remainder of the year is as yet unknown. The infestation reaches its peak in August, September and October.

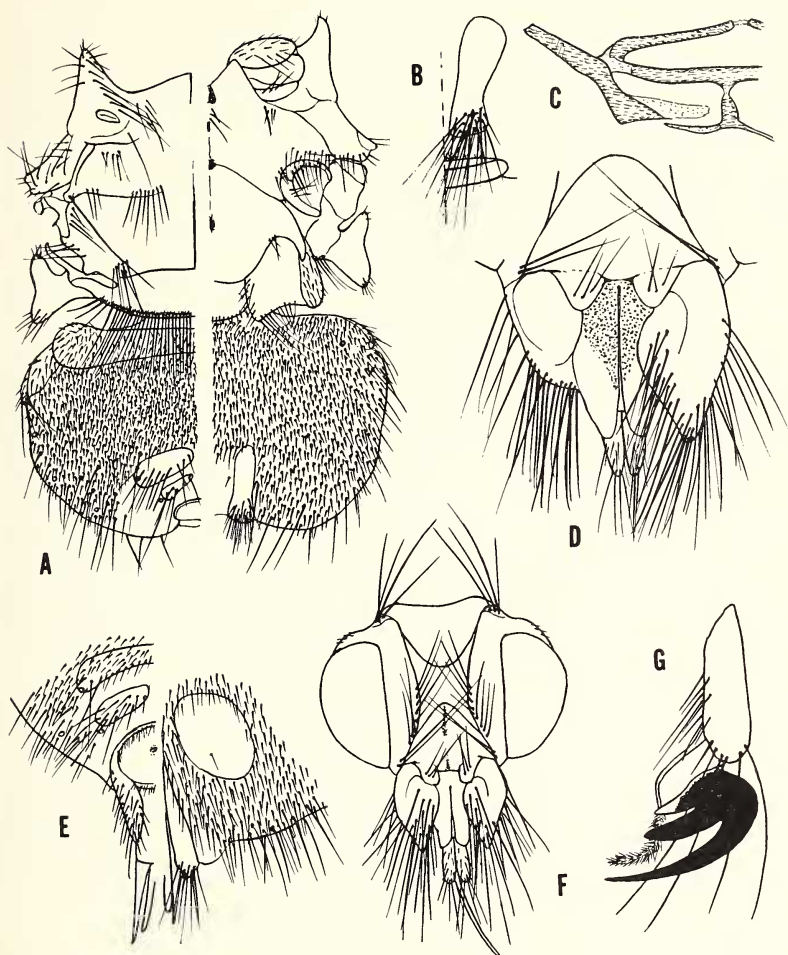


Fig. 47. *Stilbometopa impressa* (Bigot): **A**, thorax and abdomen dorsally and ventrally, ♀, Shandon; **B**, pregenital ventral sclerite, ♀, Shandon; **C**, anal cell, ♂, Bitterwater; **D**, frontal area of head, 2nd segment of one antenna removed, ♀, Bitterwater; **E**, apex of abdomen dorsally and ventrally, ♂, Bitterwater; **F**, head, ♀, Bitterwater; **G**, distitarsus and claw of hind leg, ♀, Bitterwater; all from flies on *Lophortyx c. californica*.

Dr. Tarshis found a puparium of *S. impressa* in the crop of *Lophortyx californica* at Bitterwater, California, on December 16.

Herman (1944, 1945) published a few notes on the larva and puparium and also figured some puparia. The early stages will be described in detail by Dr. I.B. Tarshis. According to specimens received from Dr. Tarshis, the normal, fully-formed puparium (Figs. 50B-E) is 5.3 to 5.5 mm. long, 4.9 to 5.1 mm. in greatest width (near mid-length), and about 3.5 mm. thick. It is broadly oval, gradually narrowed to the prominent but small posterior cap bearing the spiracular or polypneustic lobes. In profile, it is decidedly depressed, lenticular, about equally convex dorsally and ventrally, the sides forming well-marked, blunt edges. The surface is bare, moderately shiny, with a rather oily sheen; under a hand-lens it shows only irregularly scattered, shallow, pit-like punctures; but a high magnification discloses in addition a minute network of engraved lines. The broad, semi-elliptical anterior end bears a small, abruptly raised buccal papilla, with a cup-like depression at the tip. The cap at the posterior end is uniformly convex, without the usual apical, median depression or groove, but at the summit with 2 minute pits in a transverse line. The polypneustic lobes form 6 slightly raised broad ridges, 3 on each side, separated by shallow depressions slanting toward the somewhat hexagonal contour of the cap, which itself is elliptical seen from behind; each ridge bears 10 to 12 irregularly scattered respiratory pores each on a small, flattened, circular area.

Part I contains also information, mostly from Dr. I.B. Tarshis' unpublished observations, on the feeding requirements (p. 113), the host as an enemy of the fly (p. 130), the rôle in the transmission of *Haemoproteus lophortyx* (pp. 138 and 358-360), the sex ratio (p. 178), the larviposition (p. 193) and the duration of pupal development (p. 199). Meanwhile, Dr. Tarshis has published two brief summaries of some of his findings (1953a, 1953b), as well as a detailed account of the experimental transmission of *H. lophortyx* (1955a).

According to Furman and Tarshis (1953, p. 70), *S. impressa* was never found infested with mites, although over 1000 flies were carefully examined for such parasites. This is in sharp contrast with *Lynchia hirsuta*, often found with it on the same host, and which shows a high percentage of mite infestation.

Affinities. *S. impressa* is better defined than its congeners, perhaps owing to its geographical isolation and restricted host specificity. Few characters should be added to those of the key. The

slight lateral notch, visible in some specimens between the humeral callosity and the anepisternum, is often not more marked in this species than in others and is not a specific character. The meta-thoracic pleurotergite is asymmetrical, much as in *S. ramphastonis*, but the relative size of the lobes is too variable to be trusted. There are usually 2 or 3 vertical bristles at each side of the postvertex. The head (Fig. 47*F*) is much the same in both sexes; the interocular face is nearly parallel-sided, about as high as wide and only slightly less than twice the width of an eye. The preapical dorsal sclerites of the abdomen are larger in the ♂ (Fig. 47*E*) than in the ♀ (Fig. 47*A*), those of the 1st pair often fused medially in the ♂.

Original description of *S. impressa* (French text translated): "Long. 7 mm. Antennis pallide fulvis, nigro villosis; haustello superne ejusdem coloris; fronte castanea; epistomate, lateribus et macula trigona verticis nitidis; oculis rufis; thorace nitido, fusco nigro, linea mediana, sutura profunde impressa, scapulique flavidis, utrinque puncto prope radicem alarum flavido; scutello, apice, dense nigro villosa; abdomine nigro, nigro villosulo; pedibus sordide testaceis, femoribus, superne, tibiis, intus et externe sed anguste, fuscis; alis fere hyalinis, venis, costali, longitudinalibus 1-4is omnino, 5a, parum ultra transversam 1am nigram, nigro pictis, transversa 2a pallidissima. Brownish-black. Antennae, upper side of proboscis, fulvous-yellow; long, black setae on antennae; frons [interocular face] brown, triangle on vertex [postvertex], inner margin of orbits, epistome [frons], shiny; eyes reddish; thorax blackish-brown, shiny, with the longitudinal furrow and suture deeply marked; scutellum with a strong longitudinal furrow; humeral protuberance yellowish, with a basal blackish spot and a yellowish dot near base of wing; scutellum with a long fringe of stiff, black setae; abdomen dull black, with small black setae; legs pale fulvous; a few black setae on femora, above; inner and outer edges of tibiae brownish; hind tarsi black; wings nearly hyaline; entire costa and 1st to 4th longitudinal veins, the 5th longitudinal to a little beyond 1st cross-vein, the 6th longitudinal to 2nd (inner) cross-vein, and the 1st (outer) cross-vein, black; 2nd cross-vein and remainder of veins pale. The two basal cells very unequal; 2nd longitudinal vein meeting 1st and the two meeting costa opposite 1st cross-vein." The specimen which I saw in 1951 labelled as type in the old Bigot Collection, now part of the J.E. Collin Collection at Newmarket, is a male taken in California by Lord Elsingham in 1873. Its wing is 8 mm. long. The Bigot Collection contains also a female of the species, from the same source, so that the original description was presumably based on both sexes. The specimens agree with the customary interpretation of the *Stilbometopa* of California quail.

Both specimens were studied by Speiser (1902), who described them in detail as follows (translated from the German): "Length, 7 mm.; from oral margin to hind margin of scutellum, 4.5 mm.; of wing 8 mm. Very dark olivaceous-brown with paler legs, mouth-parts and areas on thorax. Of very robust build; femora not as narrow as usual in Hippoboscidae. Head broader than long, with wide antennal appendages as in *Ornithoctona*; but between them the 'clypeus oris' [frons] extends forward in the shape of a narrow peg composed of two halves separated by a deep slit. The 'clypeus oris' [frons] is entirely horn-yellow (as are also the antennal appendages bearing black bristles), about $\frac{2}{3}$ of the length of remainder of "Stirn" [mediovertex + postvertex] and with a round, small pit near upper margin. Postvertex about the shape of an equilateral triangle bluntly rounded off anteriorly, with anterior margin about as far from frontal suture [ptilinal suture] as the length of postvertex. Face equally wide throughout. The maxillary palps (sheath of the proboscis) extend only very

slightly beyond the 'clypeus' [frons]. The thorax is not only provided anteriorly, on either side of head, with a pair of spiniform protuberances [humeral callosities], but the pleuron is also extended on each side, before hinge of wing, as a strong spine, yellow at tip. The scutellum is actually long, as it were pillow-shaped and continues laterally in a pair of short ledges which are separated by furrows from the hind margin of the 'scutum mesonoti' [mesoscutum]. However, a very conspicuous structure stands out ventrally from these ledges; from the cavity bearing the halteres, between wings and scutellum, two large hammer-shaped (or better, halter-shaped), solid structures [modified metathoracic pleurotergites] project, whitish-yellow with several black bristles; they recall in shape somewhat the appendages on the prothorax of *Podops innunctus* Fabr., one of the Hemiptera. These structures must be referred to the metathorax from their position, which makes them particularly remarkable. I was unable to determine their relation to the second pair of spiracles; but in any case the halteres are placed below and behind them. This structure is very striking, more so than the scutellum; we find on the latter a row of notches, as mentioned by Coquillett, and a strong festoon of very heavy, black bristles, concavely curved downward, which continue laterally on the ledges mentioned above, becoming of course gradually smaller."

Stilbometopa podopostyla Speiser

Figs. 46B, 48A, 49A, and 50G and K

- Stilbometopa podopostyla* Speiser, 1904, Ann. Mus. Nat. Hungarici, 2, p. 394 (no sex; no host. Brazil: States of Matto Grosso and Rio Grande do Sul, without precise locality. Five cotypes, 1 in Budapest Mus., 1 in Berlin Mus., 3 in Vienna Mus.); 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304. Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, pp. 178 and 196; Pl. 27, fig. 1; Pl. 28, fig. 1 (no sex. Brazil: on *Scardafella "squamosa"* [*S. s. squammata*] and *Columba rufina sylvestris*, in the States of Minas Gerais, Espirito Santo and Piahy). Bau, 1930, Kownowia, 9, pt. 3, p. 210 (Bolivia: N. Chiquitos). J. Bequaert, 1935, Revista de Entomologia, Rio de Janeiro, 5, pp. 324 and 325, fig. 1C. Neveu-Lemaire, 1938, Traité Entomologie Médicale Vétérinaire, p. 893. Brennan, 1938, Science, 88, p. 571 (Texas: San Antonio, on *Zenaidura macroura carolinensis*). J. Bequaert, 1939, Op. cit., 89, p. 268. Huff, 1939, Jl. Amer. Vet. Med. Assoc., 94, p. 619. Howell and Stiles, 1941, Jl. Amer. Med. Assoc., 116, p. 1517 (Oklahoma: biting Man). McClure, 1943, Iowa Agric. Expt. Sta., Research Bull., 310, p. 406. J. Bequaert, 1943, Bol. Entom. Venezolana, 1, (for 1942), No. 4, p. 81; 1943, Jl. of Parasitology, 29, p. 132. Anduze, Pifano and Vogelsang, 1947, Bol. Entom. Venezolana, Num. Extra, p. 6. Herms, 1950, Medical Entomology, 4th Ed., p. 414. Schuurmans Stekhoven, 1952, Beiträge zur Fauna Perus, 3, Wissenssch. Bearbeit., pp. 91 and 101 (Peru: Huayuri, in pigeon nests). Figueroa, 1952, Acta Agron., Palmira, 3, pt. 1, p. 5 (Colombia: Palmira, on domestic pigeon).
- Stribbometopa podopostyla* Lizerand, 1953, Maladies du Gibier à Plumes, (Paris), p. 94.
- Stilbometopa podostyla* Bodkin, 1919, Brit. Guiana Dept. Sci. Agric., Rept. for 1917, p. 62 (British Guiana: N.W. District, on *Leptotila verreauxi*). Error for *podopostyla*.
- Stilbometopa nepodostyla* Cleare, 1919, Brit. Guiana Med. Annual for 1919, 22nd Year, Demerara, p. 70 (same record as Bodkin, 1919). Error for *podopostyla*.
- Stilbometopa podopystyla* Coatney, 1938, Science, 88, p. 258 (Nebraska: Peru, on *Zenaidura macroura carolinensis*). Coatney and West, 1940, Amer. Jl. Hyg., 31, Sect. C, p. 12. Error for *podopostyla*.

Stilbometopa columbarum Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 178 (no sex; name proposed tentatively for specimens from Brazil referred to *podostyla*, as listed above, and regarded as cotypes of *columbarum*).

Distribution and Specimens Examined. UNITED STATES. ARIZONA: Arlington, Maricopa Co., on *Zenaida a. asiatica*, June 7 (A. Wetmore). — KANSAS: Salina, Salina Co., on wild pigeon (E. Moore). — NEBRASKA (recorded by Coatney, 1938; Coatney and West, 1940): Peru, Nemaha Co., on *Zenaidura macroura carolinensis*, Sept. (G.R. Coatney). — OKLAHOMA (recorded by Howell and Stiles, 1941): Ponca City, Kay Co., biting Man, June 8 (Arfte; D.E. Howell and G.W. Stiles). — TEXAS (recorded by Brennan, 1938): near San Antonio, Bexar Co., on *Zenaidura macroura carolinensis*, Sept. 24 (J.M. Brennan).

MEXICO: San José del Cabo, Baja California, on *Zenaidura macroura marginella* (G. Augustson); La Majada, Munic. Apatzin-gan, 1200 m., State of Michoacan, ♀ ♂ on dove (H. Hoogstraal and R. Traub); Champotón, State of Campeche, on *Leptotila verreauxi fulviventris* (R.A. Paynter, Jr.).

GUATEMALA: Uaxactun, Petén, on *Crypturellus b. boucardi* (J. Van Tyne).

REPUBLIC OF HONDURAS: Lancetilla near Tela.

COLOMBIA (recorded by Figueroa, 1953): Buga, Dept. Valle del Cauca, on domestic pigeon (S. Renjifo-Salcedo); Cali, Dept. Valle del Cauca, on domestic pigeon (S. Renjifo-Salcedo); Palmira, Dept. Valle del Cauca, on domestic pigeon (P. Losada S.).

VENEZUELA: Los Robles, Guaira, on *Leptotila v. verreauxi* (P. Anduze).

BRITISH GUIANA (recorded by Bodkin, 1919, as *S. podostyla*: Cleare, 1919).

BRAZIL (recorded by Speiser, 1904; Lutz, Neiva and da Costa Lima, 1915, as *S. podostyla* or *S. columbarum*): Nova Teutonia near Itá, State of Santa Catharina, on *Columba rufina sylvestris*, *Tinamus solitarius*, *Crypturellus o. obsoletus*, and *Chamaeza c. campanisona* (F. Plaumann); Ipamiry, State of Goyaz, ♂ on domestic turkey (J. Lane); State of Goyaz, on dove (J. Lane); Japuhya near Angra dos Reis, State of Rio de Janeiro (L. Travassos); Hyutanaban, Rio Purús, State of Amazonas, on *Tinamus* sp. (S.M. Klages); near Cachoeira, State of Rio Grande do Sul, on "caracua" (Henninger); Lassance, State of Minas Gerais, on *Scardafella s. squammata* (Ad. Lutz. — Cotype ♀ of *S. columbarum*); Ilha Seca, State São Paulo (Inst.Osw.Cruz); Paranagua, State of Piauhy, on *Columba rufina sylvestris* (A. Neiva. — Cotype ♀ of *S. colum-*

barum); Barra do Tibagi, Rio Paranapanema, State of São Paulo, on *Leptotila verreauxi decipiens*.

PARAGUAY: San Bernardino (K. Fiebrig); Villarrica, ♂ on domestic chicken (F. Schade).

ECUADOR: Guayaquil, on domestic pigeon (F. Campos R.).

PERU (recorded by Schuurmans Stekhoven, 1952): Valle Chamayo (W. Weyrauch).

BOLIVIA (recorded by Bau, 1930).

ARGENTINA: Las Palmas, Chaco, on *Leptotila verreauxi chalcauchenia* (A. Wetmore); Cerro de San Javier, Prov. Tucumán, on *Leptotila verreauxi chalcauchenia* (O. Budin and Gomez).

S. podopostyla is essentially a Neotropical insect, common and widespread throughout continental Central and South America. In the Antilles it appears to be replaced by *S. fulvifrons*. The few Nearctic records seem to be based on stray flies arriving in the spring from farther south on migratory hosts or acquired from such during the summer by other birds. It is doubtful that the species can maintain itself permanently through the winter north of the Tropic of Cancer. The northmost capture is from Nebraska in about 40° 30' N. and the southmost from northern Argentina in about 27° S.

Known Hosts of *S. podopostyla* (verified individual records in parentheses). Tinamiformes (4): *Crypturellus b. boucardi* (1); *C. o. obsoletus* (1); *Tinamus* sp. (1); *T. solitarius* (1). Galliformes (2): **Gallus gallus bankiva* (1); *Meleagris g. gallopavo* (1; on domesticated birds). Columbiformes (17 and 2 unidentified doves): **Columba l. livia* (5); *C. rufina sylvestris* (2); *Leptotila v. verreauxi* (1); *L. verreauxi chalcauchenia* (2); *L. verreauxi decipiens* (1); *L. verreauxi fulviventrifrons* (1); *Scardafella s. squammata* (1); *Zenaida a. asiatica* (1); *Zenaidura macroura carolinensis* (2); *Z. macroura marginella* (1). Passeriformes (1): *Chamaeza c. campanisona* (1).

Bionomics. What little is known of these for *S. podopostyla* was mentioned in Part I in discussing infestation with mites (p. 155), host relations (p. 329) and effect of the bite on Man (p. 344).

The host records, though few, show conclusively that wild Columbidae are the main breeding hosts, from which the fly passes sometimes to domestic pigeons. Tinamous also are possibly effective breeding hosts. The very few occurrences on other types of birds (2 on domesticated Galliformes and 1 on a Passeriformis) may be dismissed as accidental.

In the Nearctic Region, 4 of the 5 records are from wild doves and the fifth is based on an attack on Man; all are, moreover, from

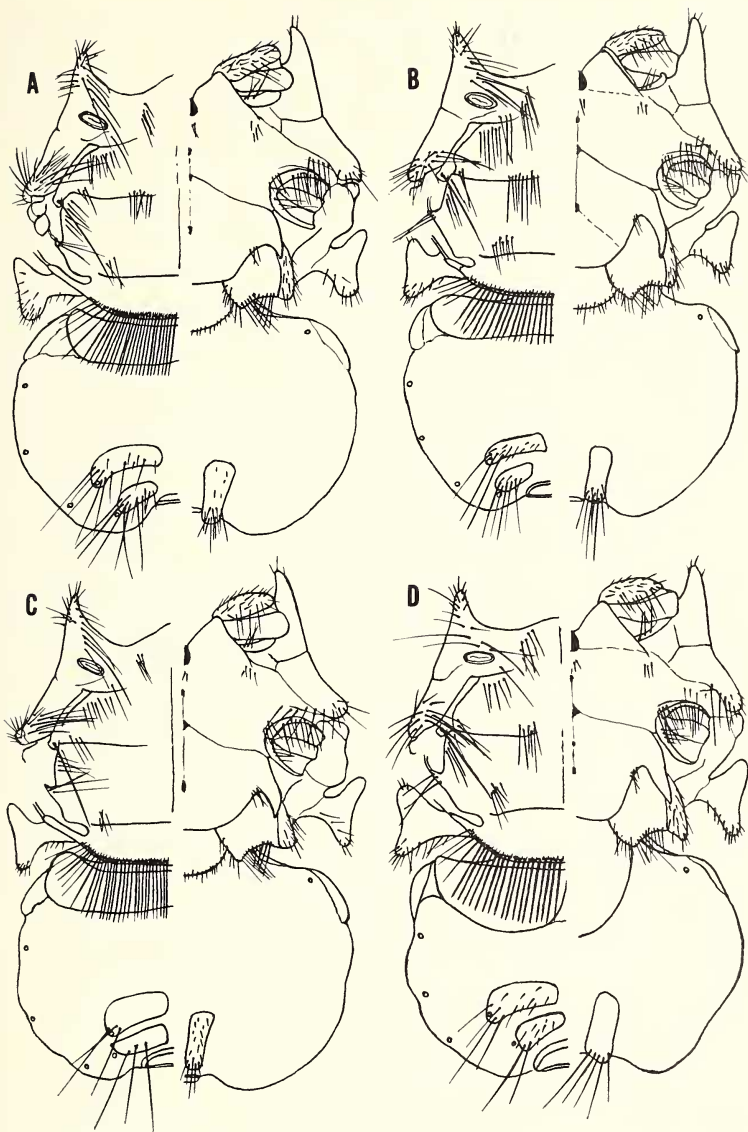


Fig. 48. Thorax and abdomen dorsally and ventrally of *Stilbometopa*: **A**, *S. podopostyla* Speiser, ♀, Champotón, on *Leptotila verreauxi fulviventris*; **B**, *S. ramphastonis* Ferris, ♀, Joinville, on *Pipile jacutinga*; **C**, *S. fulvifrons* (Walker), ♀, Baraguá; **D**, *S. legtersi* J. Bequaert, ♀ holotype, Xocempieh. Setae of abdomen shown on basal and preapical sclerites only.

the summer months (June to September). These seasonal and sporadic captures, in spite of the large size, suggest that *S. podopostyla* is not a permanent member of the Nearctic fauna, but is unable to survive the winter there either as adult or as puparium.

Affinities. *S. podopostyla*, *S. fulvifrons*, and *S. ramphastonis* are very closely related and Ferris (1930c, p. 64) suggested the possibility that they might be "the same thing." The material available of *S. fulvifrons* and *S. ramphastonis* is too scant to settle their status conclusively; in particular, more information is needed on the true breeding hosts. *S. podopostyla* and *fulvifrons*, however, differ markedly in the size of the metasternal spurs. Other minor differences are more difficult to appreciate except by direct comparison, and this is particularly true for the shape of the outer hind edge of the anepisternum. In both species the median occipital inward curve is similar, but somewhat deeper and narrower in *podopostyla*. It is wider and shallower in *S. ramphastonis*, which, moreover, shows other, presumably more reliable differences given in the key. The presence or absence of a pit on the postvertex and the length of the tips of the antennal processes, used in an earlier key (1935b, p. 324), appear unreliable when the specimens are sorted by the length of the metasternal spur. In the ♀ the two pairs of preänal dorsal sclerites are much less setose in *S. fulvifrons* than in *S. podopostyla*.

The sexes differ little; but the four posterior tergal and the two ventral preapical sclerites of the abdomen are much larger in the ♂. The interocular face is about the same width in both sexes (Fig. 49A); it is about as wide at the upper eye margins as high and often more narrowed toward the lunula than in *S. fulvifrons*.

Original description of *S. podopostyla* (translated from the German): "Length, 6.5 mm.; from margin of mouth to scutellum, 4.5 mm. Umber-brown, with leather-brown markings. Head yellowish-brown. Clypeus [frons], margins of eyes [inner orbits] and triangle of vertex [postvertex] somewhat darker. Occiput produced posteriorly for some distance above hind margin of eye, and this area emarginate behind. Triangle of vertex [postvertex] with a very fine median excision anteriorly. Inner sides of broad, shiny margins of eyes [inner orbits] convergent forward. Clypeus [frons] of the usual, sharp bow-shape, with rather deep pit. Antennal appendages broad and flat, rather long, longer than maxillary palpi, which are straight and narrow. Under side of head uniformly leather-yellow. Structure of thorax exactly as I described in detail for *S. impressa*, except that in my new species the spines before the wing articulation are not as strong and long, and should be called knobs rather than spines. I have named the species for the characteristic hammer-shaped appendages of the metathorax, which recall those on the pronotum of the bug *Podops inuncta* Fabr. The ground color of the thorax is dark brown with a bronze-green gloss. Middle of anterior margin with a pair of narrow yellowish-brown streaks, which barely reach the transverse suture. The humeri also are yellowish-brown, pale particularly on the edge, and with an almost bone-white stripe from outer edge to base of wing. On either side of scutellum two paler brown spots, difficult to see; middle line of scutellum distinctly paler brownish and its hind and side

margins less distinctly so; the processes mentioned before are whitish-yellow; under side of thorax uniformly bronze-brown. Fore legs leather-yellow, with only tarsi somewhat darker; mid and hind legs brownish-yellow, with tarsi and inner and outer edges of tibiae dark-brown. Wings brownish, transparent. Subcostalis [1st longitudinal] ending in costa opposite or slightly beyond small [anterior] cross-vein; radialis [2nd longitudinal] nearer cubitalis [3rd longitudinal], so that the terminal sector of costa is to the penultimate sector as 2 : 3. The small [anterior] cross-vein is very slightly oblique, slanting from basal above to apical below; posterior [2nd] basal cell more than half the length of anterior [1st]; anal cell less than half the length of posterior [2nd] basal. Abdomen without peculiarities, black, covered with rather long black setae; a broad basal segment, and before anal opening on each side a wart-shaped knob bearing long black setae." I have not seen any of the cotypes; but the description suffices to recognize the species.

S. columbarum. Lutz, Neiva and da Costa Lima (1915) referred doubtfully to *S. podopostyla* specimens from Brazil, taken on two wild species of Columbidae. They figured the scutellum and wing and added the following notes (translated from the Portuguese): "Comparing this species [*podopostyla*] with ours we conclude that the slight differences noted do not allow us to exclude that they are identical. The main difference is in the absence of submedian and longitudinal grayish-yellow streaks over the middle of the scutum anteriorly. There are other color differences, but of minor importance, as they vary in our specimens. In addition, the venation of the wings shows small differences, the sternum in some specimens is tortoise color, the anterior margin of the scutum may be pale yellow, and finally the wings are a diluted honey-yellow, slightly infuscated, being in one specimen scarcely yellow." The trivial name *columbarum* was tentatively proposed for these specimens, in case they were later recognized as specifically distinct from *S. podopostyla*. Some of them, now at the Instituto Oswaldo Cruz, were examined through the kindness of Dr. H. de Souza Lopes. I could find no reliable character separating them from *S. podopostyla*.

Stilbometopa fulvifrons (Walker)

Figs. 46C, 48C, 49B, and 50H and L

Ornithomyia fulvifrons Walker, 1849, List Dipt. Brit. Mus., 4, p. 1145 (no sex. Jamaica, on "*Ortyx virginianus*" [*Colinus virginianus*]. Type ♂ at Brit. Mus.). Osten Sacken, 1858, Cat. Dipt. North America, p. 86; 1878, Smithsonian. Misc. Coll., No. 270, p. 213. Johnson, 1894, Proc. Ac. Nat. Sci. Philadelphia, p. 281. Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 190 (copy of description).

Stilbometopa fulvifrons Coquillett, 1899, Canad. Entom., 31, p. 336. Austen, 1903, Ann. Mag. Nat. Hist., (7), 12, p. 263 (type. Also from Jamaica: on *Sauvothera vetula*, *Geotrygon* "*sylvatica*" [*G. versicolor*], "*Geotrygon*" [*Oreopeleia*] *montana*, and "*Tityra leuconotus*" [*Platypsaris niger*]). Aldrich, 1905, Smithsonian. Misc. Coll., 46, No. 1444, p. 654 (also listed here as *Ornithomyia fulvifrons*). Speiser, 1907, Ent. News, 18, p. 103; 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 364. Gowdey, 1926, Dept. Agric. Jamaica, Ent. Bull., 4, pts. 1-2, p. 89 (misspelled "*fulviforms*"). J. Bequaert, 1935, Revista de Entomologia, Rio de Janeiro, 5, p. 324, fig. 1D; 1940, Mem. Soc. Cubana Hist. Nat., 14, No. 4, p. 318. Thompson, 1949, Ent. Mo. Mag., 85, p. 248 (Jamaica: 14½ miles E. of Kingston, St. Thomas).

Distribution and Specimens Examined. UNITED STATES. NEW JERSEY: Demarest, Bergen Co., on *Hylocichla mustelina*, May 4 (B.S. Bowdish).

ENTOMOLOGICA AMERICANA

ANTILLES. BAHAMAS: Great Salt Cay. — CUBA: without precise locality (P. Poey and J. Gundlach); Holguin, Prov. Oriente, on pigeon; mouth of Río Ojo del Toro, Prov. Oriente, Aug. 30, on *Holoquistis jamaicensis gundlachii* (H.S. Peters); Baraguá, Prov. Oriente (L.C. Scaramuzza). — ISLE OF PINES: Los Indios, on *Columba leucocephala* (G. Link). — JAMAICA (recorded by Walker, 1849; Austen, 1903; Thompson, 1949): without precise locality, on *Colinus virginianus* (♂ type of *fulvifrons*), *Saurothera v. vetula*, *Geotrygon versicolor*, and *Oreopeleia m. montana* (P.H. Gosse. — Brit.Mus.); 14½ miles E. of Kingston on Morant Bay Road, St. Thomas (G.B. Thompson).

COSTA RICA: La Fuente, ♀ (A. Alfaro).

S. fulvifrons is known thus far mainly from the Greater Antilles and the Bahamas, which may be its normal habitat. The only record from Central America could be accidental. The one capture in New Jersey was on a woodthrush, a bird known to migrate occasionally to the Bahamas, Cuba and Jamaica, though it winters more often in Central America. This seems to be a case of straggling and hardly makes *S. fulvifrons* a regular member of the Nearctic fauna (see Part I, p. 234).

Known Hosts of *S. fulvifrons* (verified individual records in parentheses). [Galliformes (1): *Colinus virginianus* (1; on introduced bird in Jamaica)]. Columbiformes (3 and 1 unidentified pigeon): *Columba leucocephala* (1); *Geotrygon versicolor* (1); *Oreopeleia m. montana* (1). Cuculiformes (1): *Saurothera v. vetula* (1). Passeriformes (2): *Holoquistis jamaicensis gundlachii* (1); *Hylocichla mustelina* (1); *Platypsaris niger*.

Bionomics. Of the 8 verified records, 4 are from Columbidae, which I regard as the true breeding hosts, mainly because *S. fulvifrons* seems to replace *S. podopostyla* in the Antilles. The remaining records from wild birds are scattered among the Cuculidae, Muscipidae and Icteridae, and the species has also been reported from one of the Cotingidae (*Platypsaris*); all these are probably accidental occurrences. Walker's so-called "type-host," the North American bob-white quail, *Colinus virginianus*, is not native in Jamaica, where it was introduced by Man. No species of *Stilbometopa* was ever taken on *Colinus* in North America.

Affinities. These have been discussed under *S. podopostyla*, with which *S. fulvifrons* is closely related in spite of the long metasternal spurs. Whether the slight differences in the shape of the occipital margin and the interocular face are fully reliable remains open to question. It should be noted that the metasternal spurs of *S. fulvi-*

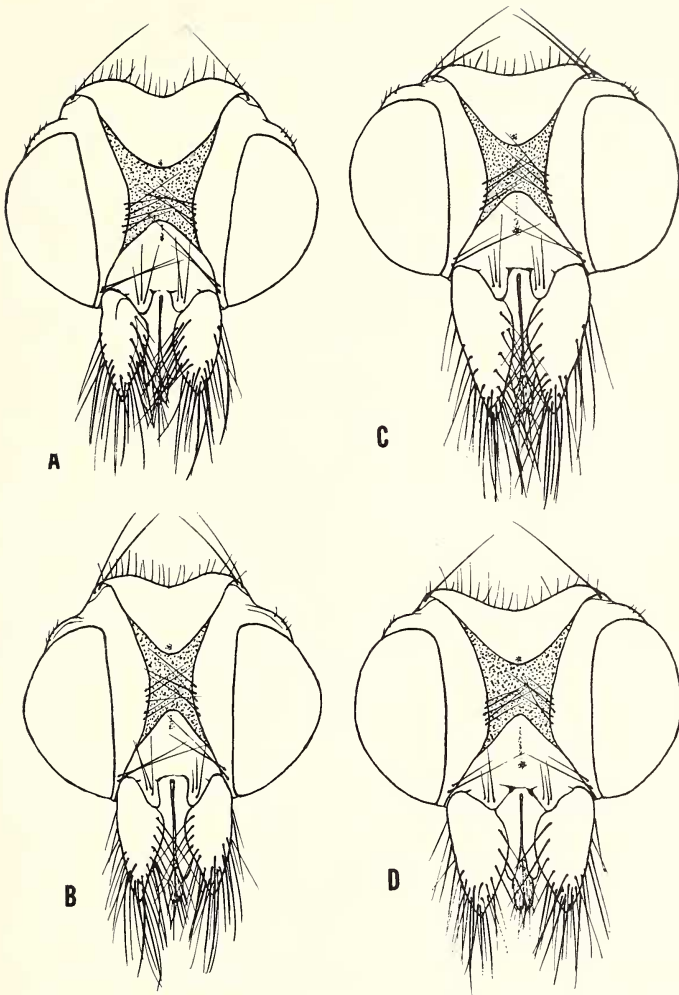


Fig. 49. Heads of *Stilbometopa*: **A**, *S. podopostyla* Speiser, ♀, Las Palmas, on *Leptotila verreauxi chalcachenia*; **B**, *S. fulvifrons* (Walker), ♀, Los Indios, on *Columba leucocephala*; **C**, *S. ramphastonis* Ferris, ♀, Sto Thomas, Izabal, on *Ramphastos* sp.; **D**, *S. legtersi* J. Bequaert, ♀ holotype, Xocempich.

frons are always shorter than those of *S. ramphastonis*, not reaching beyond mid-length of the hind coxa.

Original description of *O. fulvifrons*: "Picea, capite anteo fulvo, thoracis spinis apice flavis, pedibus fusco-fulvis, tarsis piceis, alis limpidis. Body pitchy, smooth, shining: fore part of head, mouth and all the appendages bright tawny, beset with tawny bristles; crown dull in the middle, where one longitudinal and two diagonal furrows meet: a large spine, pale yellow toward the tip, projecting on each side of the fore border of the chest, whose two furrows are obsolete at their point of intersection: hind border of the scutcheon armed with a row of short black bristles: abdomen dull, clothed with short black hairs: legs brownish tawny, beset with black bristles; feet pitchy; knees and claws black; foot-cushions yellow: wings colourless; wing-ribs and veins pitchy; fore border veins black. Length of the body 2 lines [2.3 mm.]; of the wings [span of wings] 6 lines [12.7 mm.]." I have seen the type, a male labelled "*Jamaica, *Ortyx virginianus**," at the British Museum in 1951. According to Dr. G.B. Fairchild (*in litt.*, 1953), the wing has lost the tip, what remains being 6.8 mm. long; originally it may have been 1 to 2 mm. longer. A sketch kindly made by Dr. H. Oldroyd, shows that the metasternal spurs of Walker's type are almost exactly as in my Fig. 48C; they would reach to mid-length of the hind coxae if the latter were pushed back in the articulations with the sternum.

Stilbometopa ramphastonis Ferris

Figs. 46D, 48B, 49C, and 50I and M

Stilbometopa ramphastonis Ferris, 1930, *Canad. Entom.*, 62, p. 63, figs. 1 and 2A-D and F (♀. Panama: Camp Pital, Chiriqui Prov., on *Ramphastos swainsonii*. Type at Stanford Univ., Palo Alto, California). Dunn, 1934, *Psyche*, 41, p. 175. J. Bequaert, 1935, *Revista de Entomologia*, Rio de Janeiro, 5, pp. 323 and 325, fig. B; 1940, *Mem. Soc. Cubana Hist. Nat.*, 14, No. 4, pp. 318 and 319; *Rev. Acad. Colombiana Cienc. Ex. Fis. Nat.*, 3, No. 12, p. 416. Guimarães, 1944, *Papéis Avulsos Depto. Zool.*, São Paulo, 4, No. 5, p. 79; Pl., figs. 1-2 (Brazil: Rio S. José, State of Espírito Santo, on "*Trogonurus*" [*Trogon*] *surrucura aurantius*, with 3 *Mallophaga*, *Degeeriella odontopleuron* Guimarães, attached).

Stilpometa ramphastonis Guimarães, 1944, *Papéis Avulsos Depto. Zool.*, São Paulo, 4, No. 5, p. 82.

Distribution and Specimens Examined. GUATEMALA: Sto Thomás, Izabal, on *Ramphastos* sp., ♀ with Mallophagan attached at about mid-length to the edge of the right side of the abdomen.

COSTA RICA: Turrialba, on wild pigeon [? *Columba rufina palidicrissa*] (K.C. Cooper).

PANAMA (recorded by Ferris, 1930; Dunn, 1934): Gamboa (J.G. Sanders); Camp Pital, Chiriqui Prov., on *Ramphastos swainsonii* (L.H. Dunn. — Holotype of *ramphastonis*); Tapia, C.Z., ♂ on *Columba speciosa* (J.P. Chapin).

ANTILLES. [? CUBA: Rangel, Prov. Pinar del Río, ♂ (Hno. Chrysozone. — Received from C.P. Alexander)]. — HISPANIOLA: Santo Domingo, without precise locality (Tweedie. — Brit.Mus.).

BRAZIL (recorded by Guimarães, 1944): Humboldt, State of Sa. Catharina, on *Muscivora tyrannus* (W. Ehrhardt); Joinville, near

Humboldt, State of Sa. Catharina, ♀ on *Pipile jacutinga* (W. Ehrhardt).

ECUADOR: Hacienda Guillermina, Abitagua, 1100 m., Prov. Oriente, on small green toucan (W. Clarke-McIntyre).

S. ramphastonis is strictly Neotropical, both on the Continent and in the Antilles. No doubt it is more widely distributed than the few known captures indicate.

Known hosts of *S. ramphastonis* (verified individual records in parentheses). Columbiformes (1): *Columba* sp. (1). Galliformes (1): *Pipile jacutinga* (1). Trogoniformes: *Trogon surrucura aurantius*. Piciformes (1 and 2 unidentified toucans): *Ramphastos swainsonii* (1). Passeriformes (1): *Muscivora tyrannus* (1).

Bionomics. Practically nothing is known of the life history of *S. ramphastonis*. It is not yet possible to surmise what the true or preferred breeding hosts might be, the records being far too few and too sporadic. A nearly full-grown larva partly protruding from a fly from Izabal, Guatemala, shows a polypneustic cap like that of *S. impressa*, but relatively larger, with the six radiating, broad, convex ridges more pronounced, separated by very deep grooves; respiratory pores irregularly distributed, 12 to 16 on each ridge. Part of the body visible near the cap bears the same scattered, pit-like punctures on the integument as in *S. impressa*.

Two cases of phoresy of Mallophaga, one of them also mentioned above, were recorded in Part I (p. 172).

Affinities. The following characters supplement those of the key. Process of metathoracic pleurotergite asymmetrical, the forward lobe decidedly narrower than the hind lobe, which is more broadly triangular; but the shape of the lobes varies somewhat. The shape of the antennal process also varies intraspecifically and is not to be trusted. Vertical bristles from 1 to 3 on each side. Notopleuron completely separated from prescutum by a suture, which sometimes is less conspicuous behind than in front. Metasternal spurs usually longer than in *S. fulvifrons*, often extending beyond mid-length of hind coxa.

The male (allotype) of *S. ramphastonis*, from Tapia, agrees with the ♀ except in the terminalia and the usual sexual differences in the preapical sternites and tergites of the abdomen. Wing 8 mm. long. As compared with *S. legtersi* (Fig. 50A), basal sternite (as in ♀) short and regularly transverse, without deep, median notch; 1st pair of preapical tergites completely fused into a transverse, ribbon-shaped sclerite not contracted medially; 2nd pair touching or perhaps partially fused medially; all preapical tergites at the sides with

more long, stiff bristles than in *legtersi*; preäpical sternites as large as in *legtersi*, being in that species and in *ramphastonis* much larger than in *S. impressa* (Fig. 47E).

The male from Rangel, listed above, is referred only tentatively to *S. ramphastonis*, with which it agrees in most characters, notably in the shape of the anepisternum, the very long metasternal spurs, and the broad, shallow inward curve of the occipital margin. It differs, however, in that the notopleuron is only incompletely divided from the prescutum, the two being fused over nearly the posterior half (as in *S. fulvifrons*). The wing is 8 mm. long. Future collecting in Cuba will have to decide whether or not this male belongs to another species, possibly undescribed.

Original description of *S. ramphastonis*: "Female. Length on slide, 9 mm.; length of wing, 9 mm. Head, with the antennae and their hairs, of a light red color both dorsally and ventrally, the eyes dark; thorax above glistening black, venter of thorax black; front legs reddish, others black; wings brownish. As compared with *S. impressa* this species is distinguished structurally chiefly by the form of the anepisternum of the mesothorax. In *S. impressa* this sclerite forms a short angular truncate process, while in *S. ramphastonis* it is smoothly rounded and not at all prominent. The pleurotergal process has the posterior angle obtuse, while in *S. impressa* it is quite strongly produced. The head in *S. impressa* is noticeably shorter and relatively broader, with antennae apparently smaller and shorter. Otherwise there seems to be but little difference between the two species except in color, *S. impressa* having the head black. Also in *S. impressa* the wings are distinctly paler, being quite hyaline and the anal vein is very indistinct." I was able to study the holotype at the Museum of Stanford University in 1953. The species is easily recognized from the original description and figures. It should be noted, however, that the shape of the metathoracic pleurotergal process varies and is not always as figured by Ferris.

Stilbometopa legtersi, new species

Figs. 46E, 48D, 49D, and 50J and N

? *Stilbometopa* sp. Travassos and Teixeira de Freitas, 1941, Mem. Inst. Osw. Cruz, 35, (for 1940), pt. 3, p. 533 (Brazil: Salobra, State of Matto Grosso, on *Ortalis canicollis pantanalensis*).

Female. Head (Fig. 49D) seen in front about $1\frac{1}{3}$ times as wide across eyes as high from occipital margin to tip of interantennal area of frons. Interocular face almost parallel-sided, at its narrowest nearly $1\frac{2}{3}$ times the width of an eye, scarcely higher than wide. Inner orbit smooth, at its widest slightly over half the width of mediovertex; orbital bristles very few and weak, 3 or 4 in a short, irregular row at about mid-height of face and 1 or 2 short ones near lower corner of lunula. One moderately long vertical bristle (also in ♀ paratypes). Occipital margin with a deep, broad, very even, median inward curve and distinct lateral sinuities between postvertex and hind margin of upper orbits. Postvertex crescent-

shaped, slightly shorter than mediovertex, smooth, evenly curved and entire anteriorly, without pit or depression. Frons: lunula about as long as mediovertex, triangular with broadly rounded upper angle, smooth, the upper half with a shallow longitudinal depression ending in a slight median pit; lower portion of frons only superficially divided from lunula at extreme sides (close to antennae), forming a broad interantennal area, about as long as lunula, slanting roof-like under antennal appendages, divided over most of its length by a linear slit whose margins diverge slightly apicad at the palpi. Antenna (Fig. 50*N*): 1st segment only partly divided from the lunula by short depressions at the inner and outer corners, smooth and bare; leaf-shaped appendage of 2nd segment broader than usual in the genus, nearly twice as long as wide, elongate oval, the apical third broadly triangular with bluntly rounded apex, the inner and outer margins about equally convex; surface of appendage with only a short inner basal, elongate depression, moderately setose, longer bristles restricted to outer apical area. Palpi short, moderately thick, extending little beyond tips of antennal appendages, with a few scattered short setae and longer bristles apically. Head beneath with many long bristles (vibrissae) irregularly bunched on upper side ridges of buccal cavity. Thorax (Fig. 48*D*) about $1\frac{1}{4}$ times as wide as long seen from above, shaped as usual in the genus, except as follows: anterior margin of prescutum deeply bisinuate, broadly and evenly convex in the middle, the corresponding swollen antero-median third of prescutum forming an elongate, triangular welt with the long, narrow apex directed backward; suture between humeral callosity and anepisternum obsolete, replaced by the raised hind margin of the callosity; notopleuron completely divided from prescutum by a suture which is only somewhat weaker behind; outer hind edge of dorsal anepisternum forming a simple, narrow, bluntly pointed, low lobe, directed backward, without lateral projecting angle; metathoracic pleurotergite with a nearly symmetrical anvil-shaped process, the posterior lobe being somewhat more conical than the anterior lobe but about the same length; humeral callosity with a row of 3 or 4 long bristles in front, 1 bristle at inner side of spiracle, and a few erect, short setae on the projecting point; a few setae, 2 very long, on posterior third of anepisternum; one long notopleural bristle; 2 long postalar bristles; in addition, scutum with small patches of short, irregular rows of appressed setae at inner border of humeral callosity, immediately behind posthumeral suture, in outer hind corner of prescutum, in the depression at inner end of transverse mesonotal suture, and in

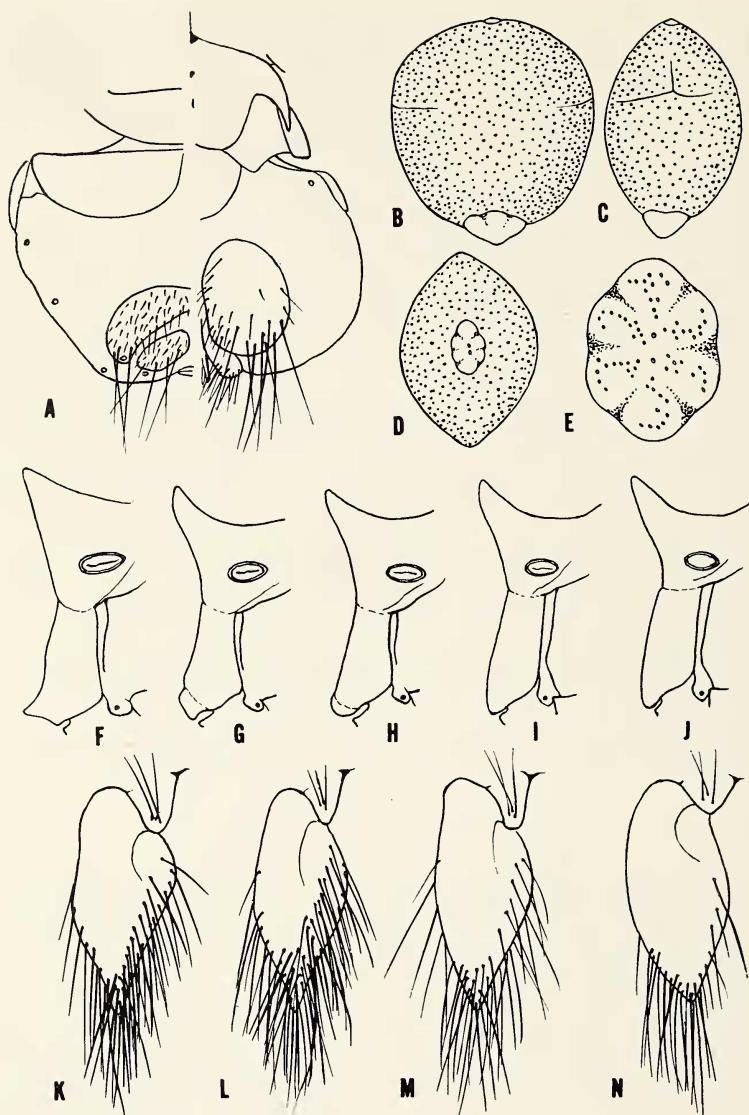


Fig. 50. **A**, *Stilbometopa legtersi* J. Bequaert, abdomen and hind part of thorax dorsally and ventrally, ♂ allotype, San Ignacio, on *Ortalis c. canicollis*; setae shown on preapical sclerites only. **B-E**, *Stilbometopa impressa* (Bigot), puparium from above (**B**), from the side (**C**), from the top (**D**), and peripneustic lobes (**E**). **F-J**, humeral callosities, anepisterna and notopleura of *Stilbometopa*: **F**, *S. impressa* (Bigot), ♀, Phoenix, on *Lophortyx g. gambelii*; **G**, *S. podopostyla* Speiser, ♀, Nova Teutonia, on *Chamaeza c. campanisona*; **H**,

hind corner of mesoscutum (near scutellum); apical scutellar comb of 40 to 48 stiff, long bristles, divided into 2 groups by a very short median interruption; transverse lateral ridge of mesosternum distinctly humped or tuberculate; prosternal lobes broadly rounded; metasternal spurs unusually strong, sharp, nearly straight. Legs as usual in the genus. Wing (Fig. 46E): venation differing little from that of *S. ramphastonis*; 2nd basal cell relatively long and narrow; a 7th longitudinal vein fairly distinct in the axillary cell. Abdomen (Fig. 48D): dorsally, partly fused basal 1st and 2nd pleurotergites unusually long, divided medially by an evenly rounded, narrow inward curve continued as a notch to near the base; two pairs of preänal dorsal sclerites; ventrally, basal sternite unusually large, semi-elliptical, about as long as wide, its surface strongly convex, bare and shiny; pair of preäpical sternites as usual. Head and thorax mostly very dark mahogany-brown to black; patches on face, sides of thorax and scutellum, pleurotergal processes, antennae and legs pale dirty-yellow. Membrane of wing hyaline; veins very pale dirty-yellowish.

Length of holotype, from tips of antennal appendages to hind margin of scutellum, 4.2 mm.; of wing, 6.5 mm.; width of wing, 2.3 mm.; total length of specimen in alcohol, 6 mm. The ♀ paratype from Argentina is slightly larger, the wing being 7.2 mm. long.

Male. Agrees with the female as described above, except as follows. Two vertical bristles in allotype, one much shorter and weaker than the other (one only in ♂ paratype). Median inward curve of occipital margin somewhat shallower than in ♀. Postvertex about as long as mediovertex, with a very light, median, linear depression over anterior two-thirds, but without pit. Lunula divided from interantennal area of frons at sides only by a deep suture. Appendage of 2nd antennal segment slightly narrower than in ♀, but of the same shape. Suture between notopleuron and prescutum complete and deep throughout. Abdomen (Fig. 50A): dorsally, as in ♀, but preäpical sclerites larger, those in 1st pair partly fused medially; ventrally, basal sternite relatively shorter than in ♀, though longer than usual in the genus, very convex and bare; pair of flattened or slightly concave sternites basad of terminalia large, almost halfmoon-shaped, bristly near edges, almost bare and shiny

S. fulvifrons (Walker), ♂, Holguin, on pigeon; **I**, *S. ramphastonis* Ferris, ♀, Turrialba, on wild pigeon; **J**, *S. legtersi* J. Bequaert, ♂ paratype, Chapada. **K-N**, antennae of *Stilbometopa*: **K**, *S. podopostyla* Speiser, ♂, San Bernardino; **L**, *S. fulvifrons* (Walker), ♀, Demarest, on *Hyllocichla mustelina*; **M**, *S. ramphastonis* Ferris, ♀, Sto Thomas, Izabal, on *Ramphastos* sp.; **N**, *S. legtersi*, ♀ paratype, San Ignacio, on *Ortalis c. canicollis*.

in center. Terminalia protruding from tip of abdomen, not differing appreciably from those of *S. impressa* or *S. ramphastonis*.

Length of allotype, from tip of antennal appendages to hind margin of scutellum, 4.3 mm.; of wing, 7.5 mm.; width of wing, 2.3 mm.; total length in alcohol, 4.6 mm. The ♂ paratype (pinned) is slightly smaller, 4 mm. long to hind margin of scutellum, the wing 6.7 mm. long.

MEXICO: Xocempich, 10 miles from Chichen-Itzá, Yucatán, female holotype, without host (D.B. Legters); Pesquería La Gloria, Arriaga, State Chiapas, Dec. 11, 1951, ♀ paratype, on *Ortalis vetula poliocephala* (M. Alvarez del Toro).

BRAZIL: Chapada, State of Matto Grosso, male paratype, without host.

ARGENTINA: San Ignacio, Dept. Anta, Prov. Salta, female paratype and male allotype, taken together on "charata," *Ortalis c. canicollis*, Dec. 1953 (S. Pierotti. — Received from Dr. K.J. Hayward).

Holotype ♀ and paratypes ♀♂ at Mus.Comp.Zool., Cambridge, Mass.; allotype ♂ and paratype ♀ at Fundación Miguel Lillo, Tucumán, Argentina.

S. legtersi is possibly a specific parasite of game birds (Galliformes) of the family Cracidae, as suggested by the two captures on *Ortalis*. I suspect that the *Stilbometopa* reported by Travassos and Teixeira de Freitas (1941) from *Ortalis canicollis pantanalensis* was also *S. legtersi*. When I saw this fly some time ago, I called it *S. ramphastonis*, not realizing that it might have been a related, new species; it is not now available for study.

Affinities. *S. legtersi* is extremely close to *S. ramphastonis*, the distinctive features being indicated in the key.

Lynchia Weyenbergh, 1881

- Lynchia* Weyenbergh, 1881, An. Soc. Cientif. Argentina, 11, pt. 5, p. 195 (monotypic for *Lynchia penelopes* Weyenbergh, 1881). Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 155 (in part only; includes also species of *Olfersia* and *Pseudolynchia*). J. Bequaert, 1926, Psyche, 32, (for 1925), p. 266. *Lynchea* Szidat, 1940, Zeitschr. f. Parasitenk., 11, pt. 4, p. 579 (in the combination *Lynchea ardeae*; error for *Lynchia*). *Olfersia* Macquart, 1835, Hist. Nat. Ins. Dipt., 2, p. 640 (includes only *O. ardeae* Macquart, *O. longipalpis* Macquart, *O. fuscipennis* Macquart, and *O. americana* Leach, all of which are now placed in *Lynchia*). Schiner, 1864, Fauna Austriaca, Die Fliegen (Diptera), 2, p. 645 (first description recognizable as that of the present *Lynchia*; included only *O. ardeae*). Not *Olfersia* Wiedemann, 1830, according to Coquillett's type designation. *Alfersia* Schiner, 1853, Verh. Zool. Bot. Ver. Wien, 3, Abh., pp. 153 and 154 (error for *Olfersia*; in the combination *Alfersia ardeae*).

- Ornithophila* Rondani, 1879, Boll. Soc. Ent. Italiana, **11**, pp. 11 and 20 (monotypic for *Ornithophila vagans* Rondani, 1879, of Italy).
- Icosta* Speiser, 1905, Zeitschr. Syst. Hym. Dipt., **5**, p. 358 (monotypic for *Olfersia dioxyrrhina* Speiser, 1904).
- Ornithoponus* Aldrich, 1923, Insector Inscitiae Menstruus, **11**, pp. 73 and 77 (substitute for *Olfersia* Macquart, with description. Type by original designation: *Feronia americana* Leach, 1817).
- Ornitomyia* Dugès, 1887, La Natureza, Mexico, (2), **1**, pt. 1, p. 18 (evidently an error for *Ornithomyia*, but used only in the combination *Ornitomyia villadae* Dugès, which is a *Lynchia*).
- Lyncechia* Maliandi, 1943, Rev. Med. Veter., Buenos Aires, **25**, p. 127 (error for *Lynchia*).

Generic Characters. Fully-winged parasites of birds, sometimes with metallic-greenish sheen on head and thorax, never with dull-green haemolymph. Head inserted between the prominent humeral callosities; occiput extending over anterior margin of notum. Ocelli lacking in most species, rudimentary or present but very small in a few; position of median ocellus often indicated by a small pit. Eyes large, with many minute but well-defined ommatidia. Postvertex and frons far apart; intervening soft mediovertex much longer than either. Occipital margin usually almost straight, exceptionally slightly wavy. Frons divided by a deep, straight, transverse suture into a broad upper lunula (sometimes with a median pit or depression) and a much narrower interantennal portion (frontal carina); the latter consists of a short base followed by two long to very long (often prong-like) pointed, diverging apical arms, strongly sclerotized throughout. Antennae medium-sized; 1st segment bearing a few setae, either completely divided by a suture from the lunula (as in *L. hirsuta*, Fig. 66C) or with only traces of a suture at sides (as in *L. albipennis*, Fig. 5A); 2nd segment with a short, broadly rounded, very bristly appendage, not extending beyond lower margin of antennal pit, with a long apical, dorso-lateral slit near outer margin; arista ending in a long narrow, transparent spatula (as in *Pseudolynchia canariensis*, Fig. 11F). Palpi of variable length. Pronotum very short, in dorsal view hidden by occipital margin. Humeral callosities large but rather short, produced forward as broad, bluntly pointed lobes set off from prescutum by shallow grooves; posthumeral suture very short, deep, developed only near anepisternum; prothoracic spiracle usually long and narrow, often partly hidden, placed in dorsal hind margin of callosity; sometimes much larger and then in a more forward position. Anterior margin of prescutum as a rule nearly straight, rarely somewhat wavy; transverse mesonotal suture deep, straight, not or narrowly interrupted medially, usually before hind third of mesonotum; postalar callus fused with mesoscutum; median notal suture well marked

throughout; notopleuron completely fused with prescutum, only the hind corner, bearing one or (rarely) 2 notopleural bristles, set off by a depression or sometimes tuberculate. Dorsal portion of anepisternum broad, lathe-shaped, slightly wider posteriorly, with blunt, scarcely projecting outer hind edge. Scutellum large, semi-elliptical, with convexly curved hind margin; surface scarcely raised, with a slight antero-median, triangular, rugulose depression which continues behind as a linear groove; scuto-scutellar suture very deep, narrowly interrupted at extreme sides. Pleurotergite of metathorax low, transverse, slightly convex, without process. Presternum very short; pro-basisternum fused with mesosternum; broad area between fore coxae usually forming slight, blunt lateral ridges close to coxae, the intervening anterior margin nearly straight; in some species edges of prosternum more lobe-like and separated by a deeper, concave area; mesosternum and meta-basisternum separated by a broadly V-shaped suture forming medially a blunt forward angle in a deep furcal pit; outer hind margin of meta-basisternum usually rounded off, exceptionally produced as a metasternal tooth over base of hind coxa (in *L. bicorna* Ferris and 1 or 2 African species); metasternum divided into a basisternum and a furcasternum by a suture, which is deep and sharply triangular medially, elsewhere sometimes superficial; meta-furcasternum undivided, its hind margin straight or shallowly concave; a median sternal suture over pro-basisternum, mesosternum and meta-basisternum. Metathoracic spiracle placed immediately behind and below the pleurotergite, between halter and hind coxa. Legs usually long, rather slender; femora barely swollen; tibiae flattened; tarsal segments 1 to 4 broad, short, those of fore legs sometimes asymmetrical, the 4th segment being thumb-like at apex on one side; hind basitarsus much lengthened, without transverse comb of setae beneath; tips of tibiae normal; tibial spurs weak, bristle-like. Claw divided to near base into two long, slender teeth, the outer one very sharp, the inner one slightly shorter and blunter; basal "heel" also narrow, tooth-like, but shorter than the true teeth (claw seemingly tridentate); empodium and 2 pulvilli present. Wing usually large; venation (Fig. 14F) incomplete, without posterior basal (or anal) cross-vein; anterior basal cross-vein placed much basad of anterior cross-vein; 2nd basal cell much shorter than 1st; 1st to 3rd longitudinal veins ending in costa at sharp angles; subcosta complete or incomplete (not reaching costa); 2nd longitudinal free throughout, ending in costa closer to tip of 3rd than of 1st; bullae extensive in basal elbow of 4th longitudinal and particularly in anterior basal

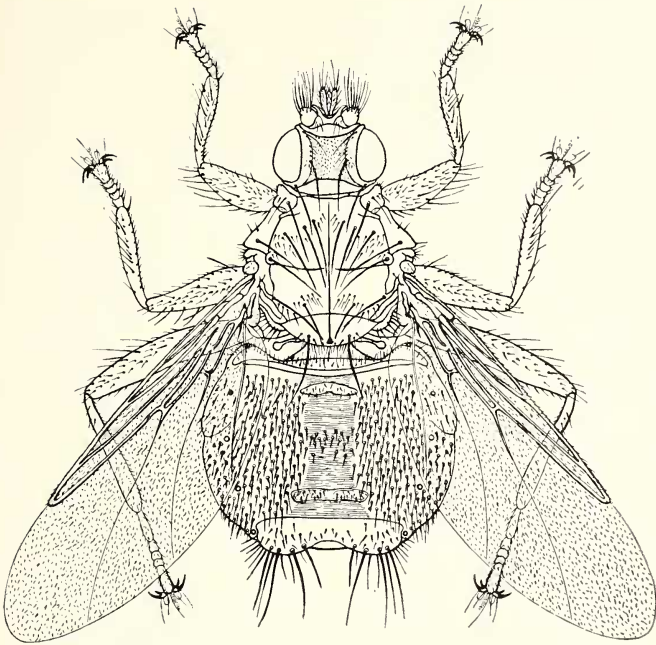


Fig. 51. *Lynchia hirsuta* Ferris, ♀, Jolon, on *Lophortyx c. californica*.
 × about 10.

cross-vein (which may seem almost effaced); costa setulose; all other veins bare; membrane covered partly or mostly with microtrichia, the area covered being characteristic for each species; alula usually very narrow or rudimentary, sclerotized throughout, rarely (as in *L. hirsuta*) wider and membranous; calypteres almost reduced to the thickened setulose margin, the distal one the larger and set off by notches from both the proximal one and the alula; proximal calypter a narrow semi-membranous ledge continuous with the posterior ridge of the parascutellum. Dorsum of abdomen with the usual comparatively short basal two pleurites fused and continuous across the middle; often in addition one or more small median sclerites (sometimes lacking, as in *L. nigra*); a large, transverse preanal sclerite, often partly divided by a median depression or by wavy margins; middle of dorsum a continuous, somewhat sclerotized, shiny area, closely covered with very fine transverse striae. Seven pairs of abdominal spiracles as follows: 1st close to insertion of abdomen, in ventral edge of 1st pleurite; 2nd close to antero-lateral edge of 2nd pleurite, usually somewhat ventrally; 3rd, 4th and 5th

dorso-lateral, free in the membranous integument; 6th also dorso-lateral, but very near or even within outer edge of large preanal sclerite; 7th ventral, some distance from side of anal opening; the dorsal or ventral position of the spiracles may shift as the abdomen expands or contracts. Body as a rule moderately hairy, rarely more hirsute (mesonotum entirely setulose in the African *L. pilosa* Macquart); chaetotaxy variable according to the species; usually only one vertical bristle at hind corner of upper orbit. Scutellum with only one long disco-scutellar bristle on each side, a preapical row of short, weak bristles, and an apical fringe of soft, hair-like setae; metathoracic pleurotergite setulose; sternum almost bare. Abdomen usually with fewer setae over median striate dorsal area than elsewhere. Prescutum and mesoscutum shiny, but with a fine, regular striation of engraved lines radiating from the humeral callosities, on a slant anteriorly and longitudinal elsewhere.

The male terminalia proper seem to be reduced in *Lynchia* to the aedeagus (penis and 2 penis valves), the gonocoxites being lost; instead each lateral area of the genital atrium is enlarged into a flap or lobe densely covered with stiff setulae (*setigerous lobe*, *slo*, Figs. 52*G* and 63*G*). The two lobes may be folded over the genital atrium or spread out sideways (Figs. 62 and 65). They could readily be mistaken for gonocoxites; but they appear to be homologous with the flat, partly setulose areas at the sides of the terminalia proper in *Ornithomyia* and *Ornithoetona* (Figs. 29*C* and 38*D-E*). Moreover, in certain *Lynchia*, such as *L. albipennis* (Fig. 63*G*), vestiges of the true gonocoxites seem to be present as minute tubercles bearing one seta, one on each side in the corner between the setigerous lobe and the base of the aedeagus (*GCO*, in Fig. 63*G*). The female genital atrium shows no peculiarities (Figs. 52*F* and 70*B*).

The presence in the wing of only the anterior and anterior basal cross-veins is a striking characteristic of *Lynchia*, which it shares with *Olfersia*. This involves, however, more than the mere loss of the posterior basal cross-vein, since at the same time the 6th longitudinal vein is greatly reduced or almost lost (Fig. 63*A*). Consequently the large cell (*AN*+) behind the 5th longitudinal vein consists not only of the combined anal and 3rd posterior cells, but includes also the axillary cell and is therefore limited behind by the axillary vein, more than usually developed. The cell at the basal hind border of the wing is a *postaxillary cell* (*PAX*). A vestige of the 6th longitudinal vein usually remains as a short, partly discolored and gradually fading stump at the lower basal angle of the

2nd basal cell. The stump is sometimes very weak except at the base (*L. hirsuta*, Fig. 66*G*) or barely visible. *Microlynchia*, *Pseudolynchia* and *Olfersia*, all of which have lost the posterior basal cross-vein, have the 6th longitudinal similarly reduced to a stump, which is often difficult to trace in *Olfersia*. This arrangement is possibly foreshadowed in *Stilbometopa* (Figs. 46*A-E* and 47*C*), where the basal section of the vein has a distinct break at about mid-length of the hind margin of the anal cell, beyond which the vein tends to be very weak.

The name *Lynchia* has been used in various ways, not only for species here included, but also for others properly placed in *Olfersia*, *Pseudolynchia* and *Microlynchia*. It is now restricted to the species, including the genotype, agreeing with the generic characters given above. Some of the synonyms listed are either misspellings or due to erroneous interpretations of the genotype (*Olfersia*; *Ornithoponus*). Only the following two names should be discussed.

Rondani's diagnosis of *Ornithophila* is as follows: "Antennae laminiformes margine pilis longis ciliato. Proboscis basi crassiuscula, a palpis brevibus partim tecta, lingua (in specim. nostro) satis longa filiforme. Frons ocellis tribus setigeris instructa. Alae completae, ad apicem rotundatae, non angustatae, abdomine longiores, margine antico sub-nudo; venis costalibus tribus tantum distinctis, satis proximis; areola axillare nulla, inde venis duabus tantum transversis, quarum interior valde distat ab exteriori. Abdomen parvum, lateribus ad basim productis. Scutellum margine postico in medio piligero. Pedes setulosi et pilosuli, tarsis uncos validis trifidis ferentibus." The genotype, *Ornithophila vagans* Rondani, was found near Parma, Italy, the host being unknown; no other specimen was ever recognized. The type has not been studied again, although Dr. B. Lanza informs me (*in litt.*, 1953) that it is preserved in Rondani's collection, at the Museum in Florence. Until it can be examined critically, it can only be interpreted from the description and Rondani's sketch of a wing. These agree with *Lynchia* in every respect save for the presence of ocelli. On the same evidence, Austen (1903, p. 263) referred *Ornithomyia simplex* Walker, from Celebes, to *Ornithophila*. I have reached the same conclusion after a recent (1951) examination of Walker's type. *Ornithophila maquilangensis* Ferris (1924*a*, p. 392), also from the Malay Archipelago, may be identical with *simplex* and is certainly congeneric. A study of these and other similar Malayan specimens has failed to show any character except the presence of ocelli separating them from the usual species of *Lynchia*. Moreover, at least

two other species of *Lynchia*, one African (undescribed) and the other South American (*L. plaumanni*), show either rudimentary or more or less developed ocelli, although they have all the other characters of the genus. As these ocelligerous species share no other character which might group them, evidently the sporadic occurrence of ocelli is not of supra-specific significance in this case. *Ornithophila* is not even entitled to subgeneric rank.

Icosta Speiser was proposed with the following diagnosis (translated from the German:): "Hippoboscids with lengthened basal knob ['heel'] and accessory tooth on claws, without ocelli, without anal cross-vein; anterior basal cross-vein ['hintere Querader'] present. Clypeus [frons] from ptilinal suture ['Stirnspalte'] to tips of lateral arms as long as the distance between ptilinal suture and occiput ['Scheitel'], but deeply emarginate at anterior margin, so that it is only short in the middle and forms two lateral, sharp points. Occiput ['Scheitel'] wavy and produced backward in the middle, next to which it is somewhat retracted, the anterior margin of the thorax having three corresponding inward curves side by side." In the earlier specific description of the genotype, *Lynchia dioxyrhina*, Speiser (1904d, p. 387) stated that the hind margin of the occiput and the anterior margin of the thorax were wavy, with 3 inward curves, similar to those of *Olfersia spinifera* (Leach). This and the other characters mentioned by Speiser are not, however, of more than specific value in Hippoboscidae. While the apical frontal arms are perhaps unusually long in *L. dioxyrhina*, they are prong-like in several other *Lynchia* (*L. bicorna* Ferris; *L. chalcotampra* Speiser = *L. pollicipes* Ferris; and 2 or 3 undescribed African species), while in others (*L. samoana* Ferris, for instance) they are transitional to the more normal, short condition. This peculiarity is, moreover, not correlated with any other that might be used to set off a distinct supra-specific group. It seems unnecessary to retain *Icosta* even as a subgenus.

Lynchia is cosmopolitan and the largest genus of Hippoboscidae, with some 35 presumably valid described species and a few as yet undescribed. Of the 10 American species here discussed, one, *L. penelopes*, has not been recognized since the original description, and 2, *L. nigra* and *L. albipennis*, occur also in the Old World.

Lynchia rottensis (Statz), the only known fossil hippoboscid, was discussed before (Part II, pp. 39-41). According to a recent notice (1955, *Bull. So. California Ac. Sci.*, 54, pt. 2, p. 104), the Statz Collection, containing this fossil, is now at the Los Angeles County Museum, Los Angeles, California.

Key to American Species of *Lynchia*

The characters selected for the key are those which I have found most reliable for the recognition of the species. It would be convenient to have a primary division into large species (*L. americana*, *L. wolcottii* and *L. nigra*), with the wing 7 to 9 mm. long, and small species (most of the remaining American forms), with the wing 6 mm. long or less. Unfortunately one species, *L. latifacies*, with a wing 6 to 7 mm. long, connects the two groups. Moreover, the large species sometimes produce dwarfed specimens which may lead astray. Size, although constant within fairly narrow limits for each species, does, of course, not express true kinship. It is possible that certain species here treated as distinct mainly on the basis of size, such as *L. wolcottii* and *L. angustifrons*, may eventually prove to be only large and small races of the same thing. The extent of the area covered with microtrichia in the wing varies within narrow limits and I regard it as a most reliable character. On the other hand I do not trust minor differences in the venation, so often mentioned because they are obvious. In particular, the positions on the costa of the tips of the subcosta, 1st, 2nd and 3rd longitudinal veins, in relation either to one another or to the cross-veins, are too variable intraspecifically to be trusted. Whether the subcosta is complete (ending in the costa) or incomplete (stopping in the membrane before reaching the costa) is most variable, as I show in discussing the several species. While in most species one or the other of the two conditions prevails or is constant, it is of doubtful value in a key. Color characters are not mentioned, as I regard them as worthless. *L. penelopes*, at present unrecognized, is not included in the key.

1. Interocular face narrow, at its narrowest not or scarcely wider than an eye, at its widest (at postvertex) narrower than the height of an eye. Orbital bristles few, in one row. Palpi about as long as $\frac{1}{2}$ the height of head (from occipital margin to base of palpi). Hind $\frac{1}{3}$ to $\frac{1}{2}$ of combined anal, 3rd posterior and axillary cells, as well as entire postaxillary cell, without microtrichia 2
- Interocular face wide, at its narrowest much wider than an eye, at its widest (at postvertex) as wide as or wider than the height of an eye 3
2. Large species; wing 7 to 8 mm. long *L. wolcottii*
 Small species; wing 5 to 6 mm. long *L. angustifrons*
3. Prescutum with 3 long, erect, stiff bristles in each of the lateral patches of soft, appressed setae. Orbital bristles many, in

- more than one row in upper half of orbit. Combined anal, 3rd posterior and axillary cells almost completely covered with microtrichia, but entire postaxillary cell bare. Small species; wing 4.5 to 5.5 mm. long *L. hirsuta*
- Prescutum without long, erect, stiff bristles in the lateral patches of appressed setae 4
4. Orbital bristles many, in more than one row 5
- Orbital bristles few, in one, sometimes irregular row 7
5. Large species; wing 7.5 to 9 mm. long. Interocular face at its widest about twice as wide as an eye. Palpi nearly as long as $\frac{1}{2}$ the height of head (from occipital margin to base of palpi). Hind $\frac{1}{3}$ to $\frac{1}{2}$ of combined anal, 3rd posterior and axillary cells, as well as entire postaxillary cell, without microtrichia. Lateral patches of appressed setae on prescutum extensive *L. nigra*
- Small species; wing 4.5 to 6 mm. long. Palpi much shorter than $\frac{1}{2}$ the height of head (from occipital margin to base of palpi). Combined anal, 3rd posterior and axillary cells completely or nearly completely covered with microtrichia. Lateral patches of appressed setae on prescutum small 6
6. Interocular face at its widest (at postvertex) nearly 3 times as wide as an eye (in ♀; ♂ unknown). Postvertex nearly as long as mediovertex. Occipital margin strongly arched. Postaxillary cell covered with microtrichia except for a very narrow bare hind border. Wing 4.6 to 5 mm. long. *L. holoptera*
- Interocular face at its widest (at postvertex) less than 3 times as wide as an eye (in both sexes). Postvertex much shorter than mediovertex. Occipital margin slightly arched medially. Hind half or more of postaxillary cell without microtrichia. Wing 4.5 to 6 mm. long *L. albipennis*
7. Basal hind area only of combined anal, 3rd posterior and axillary cells, as well as most of postaxillary cell, without microtrichia. Postvertex often with vestigial ocelli. Palpi at most as long as $\frac{1}{2}$ the height of head (from occipital margin to base of palpi). Small species; wing 5.5 mm. long. *L. plaumanni*
- Hind $\frac{1}{3}$ to $\frac{1}{2}$ of combined anal, 3rd posterior and axillary cells, as well as entire postaxillary cell, without microtrichia. No vestigial ocelli 8
8. Palpi about as long as $\frac{1}{2}$ the height of head (from occipital margin to base of palpi). Frons with moderately long

apical arms, the undivided base of the interantennal portion narrower than its distance from an eye. Large species; wing 7 to 8.5 mm. long *L. americana*
 Palpi decidedly longer than $\frac{1}{2}$ the height of head (from occipital margin to base of palpi). Frons with moderately long apical arms, the undivided base of the interantennal portion about as wide as its distance from an eye. Medium-sized species; wing 5.8 to 7 mm. long *L. latifacies*

Lynchia penelopes Weyenbergh

Lynchia penelopes Weyenbergh, 1881, An. Soc. Cientif. Argentina, 11, pt. 5, p. 199 (♀ ♂; on "pavo del monte, yacú or charate, *Penelope canicollis*" [*Ortalis c. canicollis*]. Argentina: Province Tucumán. Types lost). Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 155. Brèthes, 1907, An. Mus. Nac. Buenos Aires, 16, p. 302. Speiser, 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304. J. Bequaert, 1926, Psyche, 32, (for 1925), pt. 6, p. 270 (translation of original description); 1945, *Op. cit.*, 52, p. 103.

The following is the original description of the genus *Lynchia* and of the species *penelopes* (Spanish text translated). All structural characters were in the account of the genus, the description of the species mentioning only color and size. "Antennae gemmiformes elongatae setosae, lateribus hipostomatis insertae. Ocelli nulli. Tarsi unguibus tridentatis. Alae late incumbentes abdomine multo longiores, acuminatae. This genus must be placed between *Ornithomyia* and *Olfersia*. Although the antennae are button-shaped, they are longer than in *Ornithomyia* and hairy, especially at the tips, and are inserted very low down. The two compound eyes are very globular [bulging] and leave between them a wide frons [interocular face]; but there are no simple eyes [ocelli], instead of which the spot which usually bears them forms a small, dusky, somewhat raised plate [postvertex]. This lack of ocelli removes the genus from *Ornithomyia* and brings it near *Olfersia*. The tridentate claws, on the other hand, place it near the former and farther from the latter.³⁸ The wings are on the whole similar to those of *Ornithomyia* and *Olfersia*, but in the latter they are much rounded off at apex and they are also quite obtuse in the former; while in *Lynchia* they are very pointed, but at the same time very long. The head is flat, disk-shaped, as in the genera mentioned, which it also resembles in its articulation on the thorax and general appearance. The mouth-parts are very short and completely hidden within the short surrounding sheath [palpi]. The line or transverse suture, dividing the thorax into two [transverse mesonotal suture], is very distinct; but the longitudinal line [median notal suture], which is furrow-like in the other genera, is much raised in *Lynchia*, even forming a narrow ridge. The outer angle of the thorax bears an ovate spiracle, with several stiff setae on the anterior margin. Scutellum very short and broad. Abdomen with strong spines on the side margins of the segments and long setae at apex. Legs sparsely hairy, with only a few stronger setae near the claws. The venation is characteristic, though somewhat similar to that of *Ornithomyia*; but the differences outweigh the similarities. Only three veins run from the articulation to the lower [hind] margin of the wing. As in *Ornithomyia*, the veins are dark colored in the area near the anterior margin and the articulation

³⁸ The structure of the claws is the same in *Ornithomyia*, *Olfersia* and *Lynchia*. Actually each true claw is deeply bifid or bidentate, but the elongate basal heel makes it appear tridentate.

[base], as if the hollow veins were filled with opaque matter; while elsewhere the veins are delicate and hyaline. I noticed the following peculiarity of *Lynchia* in this connection: the discoidal vein [4th longitudinal] is always broken by a clear and transparent stretch, a short distance beyond the fork of the common posterior [stem-vein] into the discoidal [4th longitudinal] and the true posterior [5th longitudinal]. At first the vein seems actually interrupted there, but correct focusing proves that the break is not in the vein itself but in the substance filling the vein. I supposed originally that this was an accidental abnormality, but I now regard it as a constant feature. The costal vein [1st and 2nd sections of costa] is very short, not extending beyond one-third of the wing, where the subcostal [1st longitudinal] unites with it and then forms one-third more of the anterior margin, to the junction of the radial [2nd longitudinal] and subcostal. The mediastinal [subcosta] almost touches the subcostal [1st longitudinal], the space between them being very narrow. The transverso-basal [humeral cross-vein] is present, but is outwardly slanted between the costal [costa] and subcostal [1st longitudinal], basad of the origin of the mediastinal [subcosta] from the subcostal [1st longitudinal]. The first longitudinal [base of 2nd and 3rd longitudinals] bifurcates into the radial [2nd longitudinal] and the cubital [3rd longitudinal] very close to its own origin. The radial [2nd longitudinal] runs toward the anterior margin, where it continues for some distance as the continuation of the subcostal [1st longitudinal] and soon unites at a sharp angle with the cubital [3rd longitudinal], also in the anterior margin; the junction lies at about two-thirds of the length of the anterior margin. Along the remainder of the margin there is no vein. The second longitudinal or common posterior [stem-vein of 4th and 5th longitudinals] bifurcates almost at once beyond its origin, forming the discoidal [4th longitudinal] and true posterior [5th longitudinal]. The discoidal [4th longitudinal] runs at first somewhat toward hind margin, then bends toward the anterior margin, so that the first articular cell [1st basal cell], between the cubital [3rd longitudinal] and discoidal [4th longitudinal] and closed by the transverso-media [anterior cross-vein], is very angular outwardly. The discoidal [4th longitudinal] is connected with the cubital [3rd longitudinal] by the transverso-media [anterior cross-vein] at about two-thirds of the length of the cubital [3rd longitudinal], beyond which the discoidal [4th longitudinal] gradually curves toward hind margin of wing, where it ends at about apical fourth. The other branch or true posterior [5th longitudinal] also curves gently toward the same margin, where it ends at about mid-length. The transverso-discoidal [anterior basal cross-vein] reaches the discoidal [4th longitudinal] at the above-mentioned bend of this vein, to form the discoidal cell [2nd basal cell]. There are no transverso-posterior veins [anal and discoidal cross-veins]. The anal vein [6th longitudinal] has a double origin, is strongly curved toward the hind margin and stops at about three-quarters of the margin, as measured from the tip of the wing. The several veins of what I call the anterior system are crowded near the anterior margin, the cells and spaces between the veins being very long and narrow. Only the three posterior and the axillary cells are large and wide. The crowding of veins near the anterior margin is also seen in *Ornithomyia* but not as marked as in *Lynchia*, so that the cells between them are not so long and narrow. *Ornithomyia* also differs in lacking a mediastinal [subcosta], which is fused with the subcostal [1st longitudinal].³⁹ The transverso-basal [humeral cross-vein] is more perpendicular in *Ornithomyia*. It appears that in that genus an incomplete vein starts from the

³⁹ This is erroneous. The subcosta (or mediastinal) is present in *Ornithomyia* as well as in *Lynchia* and most other genera of Hippoboscidae. I have inserted in brackets my own terminology of the wing venation.

point where the cubital [3rd longitudinal] ends in the anterior margin, and forms a strong curve toward the tip of the wing, cutting off part of the first posterior cell, but incompletely, since this rudiment of vein does not reach the margin itself. It also seems that in *Ornithomyia* the anterior margin is bordered by a vein to within a short distance of the tip, a feature not seen in *Lynchia*.⁴⁰ In addition *Ornithomyia* has a first transverso-posterior vein placed about opposite the transverso-discooidal [anterior basal cross-vein], which it appears to extend forming with it an S-shaped figure; this feature especially produces an important difference in that part of the wing when comparing the two genera.⁴¹ In *Ornithomyia* there also seems to be a second transverso-posterior vein [anal cross-vein], very near the articulation [basally], connecting the anal [6th longitudinal] and the posterior [5th longitudinal], immediately beyond the forking of common posterior [stem-vein] into the discooidal [4th longitudinal] and the true posterior [5th longitudinal]. As I mentioned, this cross-vein is entirely lacking in *Lynchia*. Tarsi as usual in the family; halteres as in *Ornithomyia*. The specific description is as follows: "*L. sepia-obscura*, oculis subfuscis margine orbitali piceo. Antennae flavescentes extremo orbitali obscuro. Frons flavesceus. Alae hyalinae. Femora anteriora aurata. The eyes are dark reddish-brown, and an orbital, nearly black half-circle surrounds them on the frontal portion [inner orbits]. The eyes are large and spherical ['esféricos,' meaning bulging or convex], with punctiform facets. The antennae and the frons [mediovertex] are yellowish and the top of the occiput bears a triangular, dusky, somewhat raised plate [postvertex]. Labrum [frons] with a dark spot. Tip of first antennal segment [really 2nd segment] also nearly black. Thorax dark sepia; median raised line [median notal suture] brownish-black; entire thorax with a yellowish sheen, somewhat metallic, especially on the metathorax and along the margins of the scutellum, the latter bearing hairs at the hind border. Abdominal segments of the same color, very dark, their margins with a yellowish tinge at the articulations. Veins of the same general color, a little grayish, the wings very transparent and large. Halteres dirty-white. Claws of legs black; tarsal segments dark-brown, somewhat paler in the middle. Femora flat, yellowish, with nearly black upper margin, the flattened sides yellowish; tibiae of hind legs entirely dark or dark-brown. Femora of fore legs golden-yellow beneath. Articulations of all legs dark. Under side very shiny, dark sepia, metal-

⁴⁰ No specimen of *Ornithomyia* or any other hippoboscid I have seen shows the incomplete vein curving off from the tip of the 3rd longitudinal, or the extension of the costal vein to near the tip of the wing as described by Weyenbergh. This author was misled by Meigen's defective figure of the wing of *Ornithomyia*. In *Ornithomyia* the apex of the 1st posterior cell bears microtrichia on both sides of the membrane and this area is sometimes set off by a curved crease simulating a spurious vein.

⁴¹ Weyenbergh used for comparison a drawing of the wing of *Ornithomyia* by Meigen (1830, 6, Pl. 64), which explains some of his erroneous interpretations. He failed to note that the "first transverso-posterior vein" which he described in *Ornithomyia* corresponds to what he called the "transverso-discooidal" in *Lynchia*, the second basal cell being so long in *Ornithomyia* that the anterior cross-vein and the anterior basal cross-vein are close together; in *Lynchia* these two cross-veins are far apart.

lie. Labium [gula] pale brown; genitalia yellowish. Venter finely granulose or shagreened, particularly in the female. The break in the discoidal vein [4th longitudinal], mentioned in the generic description, is possibly a specific character only; but it seems to be constant. Spread of wings, from one wing tip to the other, 2.5 cm. Length, including the head, but not the wings, 1 cm. in ♀, 8 mm. in ♂."

The species has not been recognized since the description, which is most unfortunate, inasmuch as it is the type of the genus *Lynchia*. The original specimens are almost certainly lost, all efforts to trace them having failed. The detailed generic diagnosis, however, leaves no doubt that *L. penelopes* is congeneric with the species now placed in *Lynchia*; but it should be realized that Weyenbergh misunderstood the venation of *Ornithomyia* in his comparison with that of *Lynchia*. *L. penelopes* lacked ocelli, had a short postvertex separated from the frons by a long mediovertex, and had 2 closed basal cells, but no closed anal cell. These features eliminate *Ornithoica*, *Ornithomyia*, *Ornithoctona*, *Stilbometopa*, *Olfersia*, *Pseudolynchia* and *Microlynchia*. If the measurements are to be trusted, *L. penelopes* was about the size of *Ornithoctona erythrocephala*, thus exceeding the 3 large species of *Lynchia* now recognized in South America, *L. americana*, *L. nigra* and *L. wolcottii*. While the description agrees fairly well with *L. nigra*, the discrepancy in size is too great to identify *L. penelopes* with it at present, particularly as *L. nigra* has not been recorded since from *Ortalis canicollis* or one of the Cracidae. It seems more probable that the Cracidae of Argentina harbor a peculiar, specific species of *Lynchia*, as the quail do in the western United States. Weyenbergh may have been uncertain about the specific identity of the host. He follows the vernaculars "pavo del monte, yacú or charate" with the Latin name "*Penelope canicollis*." Dr. K. J. Hayward points out (*in litt.*, 1954) that only "charata" (not "charate") is used in Argentina for the gray-headed chachalaca, *Ortalis c. canicollis*; while "pava del monte" refers there to several species of guan (*Penelope*), the dusky guan, *Penelope o. obscura*, being also called "yacú." All these species of Cracidae should therefore be investigated as possible hosts of *L. penelopes*. Two flies from *Ortalis c. canicollis*, recently sent to me by Dr. Hayward, proved to be *Stilbometopa legtersi*, described above.

Lynchia americana (Leach)

Figs. 14F, 52A-G, 53A-P, 54 and 55

- Feronia americana* Leach, 1817, Gen. Spec. Eproboscideous Ins., pp. 6 and 11; Pl. 27, figs. 1-3 (no sex; no host. Georgia. Type ♀ at Brit. Mus.) [1818, Mem. Werner. Nat. Hist. Soc., Edinburgh, 2, pp. 552 and 557; Pl. 27, figs. 1-3]. Austen, 1903, Ann. Mag. Nat. Hist., (7), 12, p. 264 (type). Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 188.
- Olfersia americana* Wiedemann, 1830, Aussereurop. Zweifl. Ins., 2, p. 606. Harris, 1835, in Hitchcock, Rept. Geol. Miner. Zool. Bot. Massachusetts, 2nd Ed., p. 600 (Massachusetts). Macquart, 1835, Hist. Nat. Ins. Dipt., 2, p. 641. Walker, 1849, List Dipt. Brit. Mus., 4, p. 1141 (Ontario: Martin Fall on Albany River, 51° 33' N., 86° 33' W.). Osten Sacken, 1858, Cat. Dipt. North America, p. 86. van der Wulp, 1867, Tijdschr. v. Entom., 10, p. 128 (Wisconsin). Osten Sacken, 1878, Smithsonian. Misc. Coll., No. 270, p. 213 (Illinois. Texas: Dallas, on *Bubo v. virginianus* and *Buteo jamaicensis borealis*. Synonymizes with it *Hippobosca bubonis* Packard). Brodie and White, 1883, Check list Ins. Dom. Canada, p. 57. Howard, 1883, South Carolina, Resources and Population, p. 275 (South Carolina). Johnson, 1895, Proc. Ac. Nat. Sci. Philadelphia, p. 340 (Florida: St. Augustine, on *Otus asio floridanus*). Elliott, 1899, 29th Rept. Ent. Soc. Ontario, (for 1898), p. 59 (Ontario: Bryanton, on

Buteo p. platypterus). Johnson, 1900, 27th Rept. New Jersey Bd. Agric., (for 1899), Suppl., p. 699 (New Jersey: Haddenfield, on *Buteo jamaicensis borealis*). Howard, 1901, The Insect Book, p. 188, fig. 109 (after Packard, 1869). Aldrich, 1905, Smithson. Misc. Coll., 46, No. 1444, p. 655. Kellogg, 1905, American Insects, p. 35 (same in 2nd Ed., 1908). Washburn, 1905, Univ. Minnesota, Agric. Expt. Sta., Bull. 93, p. 163 (Minnesota: on *Strix v. varia*). Speiser, 1907, Ent. News, 18, p. 104; 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304. Johnson, 1910, Ann. Rept. New Jersey State Mus., (for 1909), p. 814; 1913, Bull. Amer. Mus. Nat. Hist., 32, p. 90 (Florida: Miami). Swenk, 1916, Jl. New York Ent. Soc., 24, pp. 130 and 132 (synonymizes with it *Hippobosca bubonis* Packard. Nebraska: Brownville, on *Bubo v. virginianus*; Westpoint, on *Buteo lagopus sancti-johannis*. Kentucky: Louisville). McIndoo, 1918, Jl. Compar. Neurology, 29, p. 468 (sense organs of wings). Lutz, 1918, Field Book of Insects, p. 277; Pl. 71, fig. Britton, 1920, Connecticut Geol. Nat. Hist. Surv., Bull. 31, p. 210 (Connecticut). Cole and Lovett, 1921, Proc. California Ac. Sci., (4), 11, p. 344 (Oregon: Corvallis, on *Bubo virginianus saturatus*). Young, 1922, Cornell Univ., Agric. Expt. Sta., Mem. 44, (for 1921), p. 261; Pl. 31, fig. 74; Pl. 32, fig. 75 (♀; morphology). Johnson, 1922, Psyche, 29, p. 83 (Massachusetts: Wenham, on *Bubo v. virginianus* and *Buteo l. lineatus*; Dover; Framingham, on *Strix v. varia*; Sherborn. New Hampshire: Hampton, on *Asio wilsonianus*. Vermont: Dunmore Lake. Connecticut: Liberty Hill, on *Bonasa u. umbellus*. Illinois: on *Buteo jamaicensis borealis*. Texas: on *Buteo p. platypterus*. California: San José, on *Tyto alba pratincola*. Without locality, on *Falco c. columbarius* and *Otus asio mcCallii*). Davis, 1922, Proc. Staten Island Inst. Arts Sci., 1, p. 65 (New York: Freeport, on *Circus cyaneus hudsonius*; Yankee Lake, Wurtsboro, Sullivan Co., on *Buteo p. platypterus*; Staten Island). Ferris and Cole, 1922, Parasitology, 14, pt. 2, p. 194, figs. 11-12 (Washington, D.C. California: San Bernardino, on *Tyto alba pratincola*). Herms, 1923, Medical Veterinary Entomology, 2nd Ed., p. 351. Champlain, 1923 (May), Forest and Stream, p. 279, fig. (no locality). J. H. Comstock, 1924, Introduction to Entomology, p. 875. Allen, 1927, American Game, 14, p. 12 (on *Bonasa umbellus*). Cole, 1927, Proc. California Ac. Sci., (4), 16, pp. 452 and 499, fig. 287 (abdominal spiracles; ♂ terminalia). Zebrowski, 1932, Audubon Yearbook, Indiana Audubon Soc., p. 48. Green and Shillinger, 1935, Minnesota Wildlife Dis. Investig., (1933-1934), (mimeographed), p. 73 (Minnesota: Pine Co., on *Bonasa umbellus*). Webber, 1950, in Craighead, Insect Enemies Eastern Forests, (U. S. Dept. Agric. Misc. Publ. 657), (for 1949), p. 529.

Ornithoponus americanus Aldrich, 1923, Insecutor Inscitiae Menstruus, 11, pp. 77 and 78. Johnson, 1925, Occ. Papers Boston Soc. Nat. Hist., 7, p. 293 (Maine; New Hampshire; Vermont; Massachusetts; Connecticut); 1925, Proc. Boston Soc. Nat. Hist., 38, p. 99 (Massachusetts: on *Buteo jamaicensis borealis*, in Harris Coll. South Carolina: Society Hill, on *Bubo v. virginianus*); 1925 Bull. Northeastern Bird-Banding Assoc., 1, p. 52. Gross, 1925, The Auk, 42, p. 431 (on *Bonasa u. umbellus* in New York and New England); 1926, Progress Rept. New England Ruffed Grouse Invest. Comm., [unnumbered p. 8]. Essig, 1926, Insects Western North America, p. 623. Johnson, 1927, Bull. Boston Soc. Nat. Hist., No. 42, p. 15. Johannsen, 1928, in Leonard, Cornell Univ., Agric. Expt. Sta., Mem. 101, (for 1926), p. 868 (New York: Buffalo; Hammondsport; Baldwinsville, on *Bubo v. virginianus*; Ithaca; Austerlitz, on *Bonasa u. umbellus*; Orient Point, Long Island, on *Buteo jamaicensis borealis*). Gross, 1931, New England Game Conference, p. 54 (Wisconsin: on *Pedioecetes phasianellus campestris*). Procter, 1938, Biol. Surv. Mt.

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- Desert, 6, Insect Fauna, p. 378 (no specimen); 1946, *Op. cit.*, 7, Insect Fauna, p. 437 (no specimen).
- Olfersia (Ornithoponus) americana* Allen and Gross, 1926, American Game, 15, p. 82 (on *Bonasa umbellus*).
- Lynchia americana* Ferris, 1927, Canad. Entom., 59, p. 248, figs. 2A-D and 3 (figures wrongly labelled *L. hirsuta*, but corrected by Ferris, 1929, *Op. cit.*, 61, p. 285, to *L. americana*. California: Montecito, on *Otus asio bendirei*). Johnson, 1929, Bull. Northeastern Bird-Banding Assoc., 5, p. 52 (Massachusetts: Boston, on *Buteo l. lineatus*; Middleboro, on *Circus cyaneus hudsonius*; West Tisbury, on *Accipiter striatus velox*; Dover, on *Bubo v. virginianus*; Monterey; Princeton. New Hampshire: Candia, on *Accipiter cooperii*. Pennsylvania: Philadelphia, on *Buteo jamaicensis borealis*. Misspelled *Lynchia americana* on p. 51); 1930, Publ. Nantucket M. Mitchell Assoc., 3, No. 2, p. 158 (no specimen). Falcoz, 1930, Encyclop. Entom., Sér. B, Diptera, 5, (for 1929), p. 48 (Indiana, on owl. Oregon, on *Otus asio* [probably subsp. *kennicottii*]). Ferris, 1930, Canad. Entom., 62, p. 67, figs. 5A, D, and F (California: on owls. West Virginia and Massachusetts: on *Bubo v. virginianus*). J. Bequaert, 1933, Psyche, 40, p. 72. Peters, 1935, Ann. Carnegie Mus., 24, p. 57 (Pennsylvania: Hartstown, on *Casmerodius albus egretta*, with Mallophaga, *Ardeicola botaui*, attached); 1936, Bird-Banding, 7, pp. 11, 13, 14, and 18 (Pennsylvania: on *Accipiter gentilis atricapillus*, *Buteo l. lineatus*, *Casmerodius albus egretta*, and *Otus asio naevius*. Ohio: on *Accipiter striatus velox*, *Buteo jamaicensis borealis* and *Strix v. varia*. South Carolina: on *Accipiter striatus velox*, *Aquila chrysaetos canadensis*, *Circus cyaneus hudsonius*, *Falco peregrinus anatum*, *Otus asio naevius* and *Bubo v. virginianus*. North Carolina: on *Buteo jamaicensis borealis*. Maryland: on *Accipiter cooperii* and *Bubo v. virginianus*. Alabama: on *Buteo lineatus alleni*. Georgia: on *Buteo lineatus alleni*. New Hampshire: on *Bonasa u. umbellus* and *Bubo v. virginianus*. New York: on *Bubo v. virginianus*. Illinois: on *Bubo v. virginianus*. Massachusetts: on *Bubo v. virginianus*). Clarke, 1936, Univ. Toronto Stud., Biol. Ser., No. 41, p. 93 (Ontario: on *Bonasa umbellus togata*). Herman, 1937, Bird-Banding, 8, p. 164 (Massachusetts: North Eastham, on *Buteo p. platypterus* and *Bubo v. virginianus*). Neveu-Lemaire, 1938, Traité Entomologie Médicale Vétérinaire, p. 982, footnote. Brimley, 1938, Insects North Carolina, p. 390 (North Carolina: Wilmington; Morehead; Onslow Co.; Roxboro; Anson Co.; Raleigh. On *Accipiter striatus velox*, *Buteo l. lineatus*, *Accipiter cooperii*, "hen hawk," *Bubo v. virginianus*, and *Phasianus colchicus*). J. H. Comstock, 1940, Introduction to Entomology, 9th Ed., p. 875. J. Bequaert, 1940, Rev. Acad. Colombiana Cienc. Ex. Fis. Nat., 3, No. 12, p. 416. Snodgrass, 1943, Smithsonian Misc. Coll., 104, No. 1, pp. 44 and 46; figs. 16A, D and E, and 17A and G (mouth-parts); 1944, *Op. cit.*, 104, No. 7, pp. 78 and 80; figs. 30A, D and E, and 31A and G (mouth-parts). J. Bequaert, 1945, Bull. Brooklyn Ent. Soc., 40, p. 30; 1945, Psyche, 52, pp. 89 and 100. Edminster, 1947, The Ruffed Grouse, p. 247. MacArthur, 1948, Bull. Publ. Mus. Milwaukee, 8, pt. 4, pp. 411 and 412, fig. 245 (Illinois: Waukegan, on *Asio wilsonianus*; Hyde Ridge, on *Buteo jamaicensis borealis*; Chicago, on *Accipiter cooperii*; Perry, on owl; Urbana; Effingham, on *Bubo v. virginianus*; Shawneetown; Willow Springs, on *Accipiter cooperii*. Iowa: Iowa City, on *Bubo v. virginianus*; McGregor. Michigan: Haslett, Ingham Co., on *Bubo v. virginianus*; Union City, on *Bubo v. virginianus*; East Lansing. Minnesota: Dodge City, on *Bubo v. virginianus*; Minneapolis, on *Strix v. varia*; Olmstead Co.; Hennepin Co.; Shakopee, on *Strix v. varia*; Anthony Park, on *Strix v. varia*. Wisconsin: Pierce Co., on hawk; Maiden Rock, Pierce Co.; W. Spring Green, Sheboygan Co., on

- Bubo v. virginianus*; Cedar Grove, Sheboygan Co., on *Accipiter cooperii* and *Buteo jamaicensis borealis*; Babcock, Wood Co., on *Bubo v. virginianus*; Portage, Columbia Co., on *Bubo v. virginianus*; Ripon, Fond du Lac Co., on *Bubo virginianus* "subarcticus" [= *B. v. wapacuthu*]; Madison, Dane Co., on *Bubo v. virginianus*; Milwaukee Co., on *Buteo jamaicensis borealis*; Golden Lake, Waukesha Co., on *Bubo v. virginianus*. Herms, 1950, Medical Entomology, 4th Ed., p. 414. Judd, 1951, Canadian Field-Natur., 65, p. 187 (Ontario: St. Thomas, 42° 48' N., on *Bubo v. virginianus*).
- Lynchia (Olfersia) americana* Champlain, 1947, Pennsylvania Game News, 18, No. 1, p. 17, fig. (Pennsylvania: on *Bubo v. virginianus*, in some 35 counties).
- [*Ornithomyia falconis* Harris, 1833, in Hitchcock, Rept. Geol. Miner. Zool. Bot. Massachusetts, 1st Ed., p. 594 (without description). Osten Sacken, 1858, Cat. Dipt. North America, p. 86. *Nomen nudum*].
- Olfersia fusca* Macquart, 1845, Mém. Soc. R. Sci. Agric. Arts Lille, (for 1844), p. 346 (no sex; no host. "New Grenada" [= probably Colombia]. Type from Bigot Coll., now in J. E. Collin Coll.) [1846, Dipt. Exot., Suppl. 1, p. 218]. Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 177 (type); 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304. Bau, 1929, Zoolog. Anzeiger, 85, p. 10 (Brazil: without definite locality, supposedly on "*Psittacus undulatus*";⁴² also Sete Lagôas, Lagôa Santa, State Minas Gerais, without host).
- Lynchia fusca* Falcov, 1930, Encyclop. Entom., Sér. B. Diptera, 5, (for 1929), p. 47 (Argentina: Misiones. Guiana). J. Bequaert, 1933, Psyche, 40, p. 76. Herms and Kadner, 1936, Jl. of Parasitology, 22, p. 541; 1937, Op. cit., 23, p. 296 (California: on *Bubo virginianus pacificus*. Puparium; experimental transmission of *Haemoproteus lophortyx* to *Lophortyx californica*). J. Bequaert, 1940, Rev. Acad. Colombiana Cienc. Ex. Fis. Nat., 3, No. 12, p. 416. Laskey, 1941, The Auk, 58, p. 97 (Tennessee: Nashville, on *Aegolius a. acadicus*). Augustson, 1942, Bull. So. California Ac. Sci., 40, (for 1941), pt. 3, p. 148 (California: Mono Lake, on *Asio wilsonianus*). J. Bequaert, 1943, Jl. of Parasitology, 29, p. 132. Herman, 1945, California Fish Game, 31, pp. 22 and 23, figs. 11D and 12 (California: Lassen Co., on *Bubo virginianus pacificus*. Infestation with mites). J. Bequaert, 1945, Psyche, 52, pp. 89 and 101. MacArthur, 1948, Bull. Publ. Mus. Milwaukee, 8, pt. 4, pp. 411 and 417, fig. 246 (Michigan: Hastings, Barry Co., supposedly on squirrel). Herms, 1950, Medical Entomology, 4th Ed., p. 414. Furman and Tarshis, 1953, Jl. of Parasitology, 39, p. 71 (California: Ripon, San Joaquin Co., on *Bubo virginianus* subsp. Infestation with *Myialges anchora*).
- Hippobosca bubonis* Packard, 1869 (April), Guide to the Study of Insects, p. 417, fig. 340 (repeated without change in later printings. ♀. On *Bubo v. virginianus*, October 5; no locality. Type ♀ labelled as from Essex Co., Massachusetts, now at Mus. Comp. Zool., Cambridge, Mass.). Brodie and White, 1883, Check List Ins. Dom. Canada, p. 57. Snow and Adams, 1903, Kansas Univ. Sci. Bull., 2, p. 221 (Kansas: Douglas Co.).
- Ornithomyia avicularia* Fitch, 1850, Trans. New York State Agric. Soc., 9, (for 1849), p. 797 (New York: Washington Co., on owl).⁴³ Not of Linnaeus, 1758.

⁴² No "*Psittacus undulatus*" is known from Brazil. *Melopsittacus undulatus* (Shaw) is an Australian parrot. Possibly the fly came from a Brazilian zoological garden.

⁴³ Asa Fitch described his fly as follows: "of a lurid-yellow color, the legs and under side of its body paler, and its wings of a slight

- Olfersia macquartii* Rondani, 1878, Ann. Mus. Civ. Stor. Nat. Genova, 12, p. 160 (no sex; no host. "New Granada" [=probably Colombia]. With new description of a specimen received from Macquart as *O. fusca*. Type in Natural History Museum in Florence). Speiser, 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304. Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 190.
- Ornithomyia rufiventris* Bigot, 1885, Ann. Soc. Ent. France, (6), 5, p. 243 (no sex; no host. Brazil: Porto Alegre. Four specimens, one now labelled as type, from Bigot Coll., now in J. E. Collin Coll.). Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, pp. 193 and 195 (copy of description).
- Olfersia rufiventris* Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 169 (type); 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304.
- Olfersia nigra* Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 181 (Brazil: without precise locality, on owls such as "*Perla flammea*" or *suindára* [= *Tyto alba tuidara*] and "*Otus clamator*" [= *Rhinoptynx c. clamator*]). Not of Perty, 1833.
- [? *Hippobosca aquilae* Brodie and White, 1883, Check List Insects Dominion Canada, p. 57 (no locality, description or host). *Nomen nudum*].
- Olfersia* sp. J.H. and A.B. Comstock, 1895, Manual Study Insects, p. 488, fig. 595 (wing). J.H. Comstock, 1924, Introduction to Entomology, p. 874, fig. 1118 (wing). Mosby and Handley, 1943, Wild Turkey in Virginia, p. 145 (Virginia: on *Meleagris gallopavo silvestris*; [specimen seen by me]).
- Lynchia* sp. J.H. Comstock, 1940, Introduction to Entomology, 9th Ed., p. 874, fig. 1118 (wing). Borror and DeLong, 1954, Introduction to Study of Insects, p. 573, fig. 27-13 (sternum).
- L. americana* has also been reported on grouse, *Bonasa u. umbellus*, in New York State, either as "*Ornithotonus*" *americanus* or as *Lynchia americana*, in the following anonymous Annual Reports of the New York State Conservation Department: 1935, 24th Rept. for 1934, pp. 277 and 278; 1936, 25th Rept. for 1935, p. 325; 1939, 28th Rept. for 1938, p. 246; 1940, 29th Rept. for 1939, p. 236; 1941, 30th Rept. for 1940, p. 221; 1942, 31st Rept. for 1941, p. 216.

Distribution and Specimens Examined. DOMINION OF CANADA.

NOVA SCOTIA: Annapolis Royal, Annapolis Co., 44° 45' N., on *Strix v. varia*. — ONTARIO (recorded by Walker, 1849; Elliott, 1899; Clarke, 1936; Judd, 1951): without precise locality, on 2 *Bubo v. virginianus* (G.S. Miller, Jr.; R. Thaxter); Chatham, Kent Co., 42° 23' N., on *Bubo v. virginianus*, Oct. 10 (L.A. Miller), and on *Bubo virginianus wapacuthu*, Jan. 10 (A.A. Wood); Dexter, Thunder Bay Co., 48° 50' N., on *Bubo v. virginianus*, Oct. 19 (G.M. Stirrett); Athens, Leeds Co., 44° 40' N., on *Bonasa umbellus togata* (M.W. Curtis); Point Pelée, Essex Co., 41° 54' N., on *Bubo v. virginianus*; Streetsville, Peel Co., 43° 30' N., on *Bubo v. virginianus* (McIvor); North Toronto, 43° 39' N., (S. Thompson); Niagara

smoky tinge expanding to the width of eighty-five hundredths of an inch [=about 21 mm.] when spread apart." This agrees with *L. americana*, the size being too large for either *Ornithomyia fringillina* or *Ornithoica vicina*, the only other hippoboscids found on owls in New York State.

Falls, 48° 7' N., on *Bubo v. virginianus* (R.M. Effrick); Erindale, Peel Co., 43° 35' N., on *Bubo v. virginianus* (Meadows); within 50 miles of Toronto, on *Bubo v. virginianus* (C. Hope); [Cornwall, Stormont Co., 45° 2' N., on *Bonasa umbellus togata*, Oct. 13 (C.P. Candee) according to D.M. Davies, *in litt.*; not seen]. — QUEBEC: Gatineau Point, Hull Co. (near Ottawa), 45° 27' N., on *Uria l. lomvia* (Hoyes Lloyd); Montreal, on *Bubo v. virginianus*, Feb. 7 (Fr. Adrien Robert); Oka, Deux Montagnes Co., 45° 28' N., on *Otus asio naevius* (Fr. Lionel Philippe).

UNITED STATES. ALABAMA (recorded by Peters, 1936): Randolph Co., on *Zenaidura macroura carolinensis* (A.O. Haugen); Florala, Covington Co., on *Bubo v. virginianus*, Jan. 21; Auburn, Lee Co., on *Otus asio floridanus*, Jan.-Feb.; Fairhope, Baldwin Co., on *Buteo lineatus alleni*, Jan. 16, and *Otus asio floridanus*, Aug. 31 (F.C. Bishopp); Sunflower, Washington Co., Jan. 1 (A.M. Pearson). — ARIZONA: Hart Prairie, San Francisco Mt., Coconino Co., on *Bubo virginianus pallescens*, Nov. 24 (L.L. Hargrave); Hualpai Mts., Mohave Co., on *Strix occidentalis lucida* (A.R. Phillips). — CALIFORNIA (recorded by Ferris and Cole, 1922; Johnson, 1922; Ferris, 1927; Herman, 1945): without precise locality, on *Speotyto cunicularia hypugaea* (W.H. Edwards); Milpitas, Sa. Clara Co., on 3½ weeks old nestling of *Bubo virginianus pacificus*, Apr. 30 (S.K. Carnie); vicinity of San Francisco (F.W. Nunenmacher); Mountain View, Sa. Clara Co., on *Bubo virginianus pacificus*, March (E.W. Ehrhorn); Talmage, Mendocino Co., on *Bubo virginianus pacificus* (J. Adder); Vina, Tehama Co., on 2 *Otus asio bendirei* (S. Freeborn; C.T. Dodds); Butte Co., on *Otus asio bendirei* (Elizabeth Ingles); Colusa, Colusa Co. (A. Wetmore); Sonoma Co., on *Tyto alba pratincola* (C. Rose); Glen Ellen, Sonoma Co. (J.A. Kusche); Healdsburg, Sonoma Co., on *Bubo virginianus pacificus* (W.E. Mack); Yountville, Napa Co., on *Bubo virginianus pacificus*, Aug. 3 (C.M. Herman) and *Otus asio bendirei*, July (T.L. Orlega); Davis, Yolo Co., on large owl; Sacramento, Sacramento Co., on owl, March 19 (F. Hartzell); Manor, Marin Co., on 2 *Strix occidentalis caurina* (E.C. Kinsey; B.B. Kessel); Ripon, San Joaquin Co., Oct. 21, on *Bubo virginianus pacificus* (O. Burnetti); Tracy, San Joaquin Co., from an owl burrow, Feb. 26 (S. Lockwood); Mono Lake, Mono Co., on *Asio wilsonianus*, Aug. 23 (R.I. Rutherford); Menlo Park, San Mateo Co. (J. Hornung); San Mateo, San Mateo Co., on *Bubo virginianus pacificus*, Dec. 30 (R. Henry); Niles Canyon, Alameda Co., on *Tyto alba pratincola* (S. Davidson); Tilden Park, Berkeley, Alameda Co., on *Bubo virginianus pacificus*, June 25 (H.E. Childs,

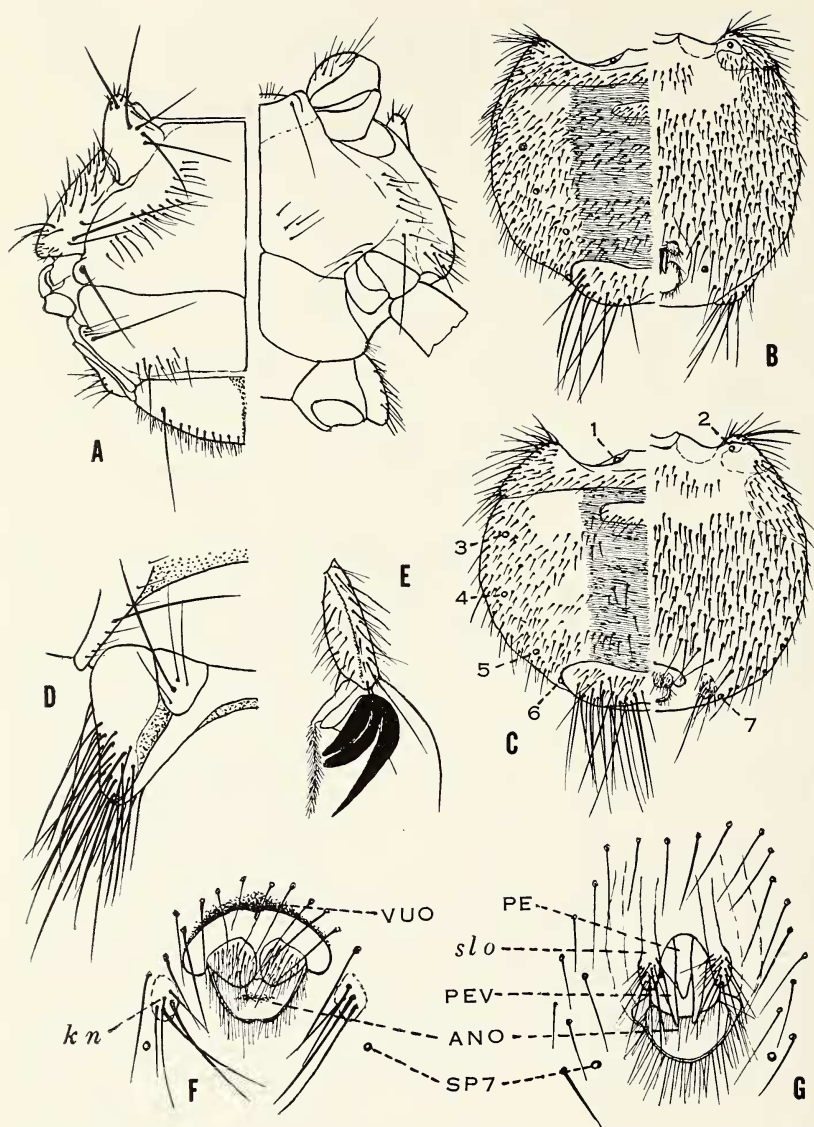


Fig. 52. *Lynchia americana* (Leach); A, Hampton, N.H., on *Bubo v. virginianus*; B and G, Ontario, on *Bubo v. virginianus*; C and F, Cameron, N.C., on hawk; D and E, Clarksville, N.Y., on *Bubo v. virginianus*: A, thorax dorsally and ventrally, ♀; B, abdomen dorsally and ventrally, ♂; C, abdomen dorsally and ventrally, ♀, spiracles numbered 1 to 7; D, antenna and adjoining frons, ♀; E, distitarsus and claw of hind leg, ♀; F, tip of abdomen ventrally, ♀;

Jr.); Stanford University, Palo Alto, Sa. Clara Co., on *Otus asio bendirei*; San José, Sa. Clara Co., on *Bubo virginianus pacificus* (Pickwell); Watsonville, Sa. Cruz Co., on owl (Hightower); Hastings Reservation near Jamesburg, Monterey Co., on *Otus asio quercinus*, May 16 (J.M. Linsdale); Huckleberry Meadow, Fresno Co. (R. Hopping); Weldon, Kern Co., on *Bubo virginianus pacificus*, March 2 (K.E. Stager); Santa Barbara, Sa. Barbara Co., on *Tyto alba pratincola* (E. Rett) and on *Bubo virginianus pacificus*; Montecito, Sa. Barbara Co., on *Otus asio bendirei*, June 25 (T.H. Hurst); Mt. Pinos, Ventura Co., on *Bubo virginianus pacificus* (I. Wilson); Santa Paula, Ventura Co., on *Bubo virginianus pallascens* (C.T. Dodds); Monrovia Canyon, Los Angeles Co., on *Bubo virginianus pacificus* (I. Wilson); Pasadena, Los Angeles Co., on *Accipiter striatus velox*, Nov. 29, and *Otus asio quercinus* (Josephine R. Michener); Puente Hills, Los Angeles Co., on *Speotyto cunicularia hypugaea* (E.L. Summers); North Whittier Heights, Los Angeles Co. (Blatz); Chino, San Bernardino Co., on *Tyto alba pratincola*, Sept. 16 (C.M. Herman); San Bernardino Co., on *Bubo virginianus pallascens* and *Tyto alba pratincola* (W.G. Wright); Mission Valley, San Diego Co. (E.W. Clark); Escondido, San Diego Co., on *Otus asio bendirei* (F.N. Gallup); Ceroville, on owl; Watch Creek, on *Bubo virginianus pacificus*, Dec. 1906, and *Tyto alba pratincola* (W. Holden). — COLORADO: without precise locality (M. James). — CONNECTICUT (recorded by Britton, 1920; Johnson, 1922): New Haven, New Haven Co., on *Strix v. varia* (R.C. Morrill); Pomfret, Windham Co., on *Bonasa u. umbellus* (P. Wallace); New London, New London Co. (C.B. Groves); Storrs, Tolland Co., on *Bonasa u. umbellus*, Jan. 18, Oct. 18, Oct. 23, Oct. 26, Oct. 27 (on 2 birds), Oct. 28 (on 2 birds), Oct. 31 (on 2 birds), Nov. 1, Nov. 4, Nov. 8, Nov. 11, Nov. 12, Nov. 13, Nov. 15, and Nov. 19, and on *Strix v. varia* (L.R. Penner); Liberty Hill near Willimantic, New London Co., on *Strix n. nebulosa* and *Bonasa u. umbellus* (O. Bangs); Sharon, Litchfield Co., on *Bonasa u. umbellus* (E.A. Deming); Westbrook, Middlesex Co., on *Bubo v. virginianus* (S. Ball); Thomaston, Litchfield Co., on *Bonasa u. umbellus* (R. S. Deck); Woodbridge, New Haven Co., on *Bubo v. virginianus* (J. LeMay); Bridgeport, Fairfield Co., on *Bonasa u. umbellus*, Nov. 5. — DELAWARE: without precise locality, on *Bubo v. virginianus* (R.M. Stabler). — DISTRICT OF COLUMBIA (recorded by Ferris and Cole, 1922): on *Bubo v. virgini-*

ANO, anal opening; *kn*, setigerous knob; *SP7*, 7th abdominal spiracle; *VUO*, vulvar opening; *G*, tip of abdomen ventrally, ♂: *PE*, penis; *PEV*, penis valves; *SP7*, 7th abdominal spiracle; *slo*, setigerous lobe at side of genital atrium.

anus (Mrs. R.C. Simpson) and *Buteo jamaicensis borealis*, Dec. 1 (B. Horsfall); Zoological Park, on *Accipiter striatus velox*, March 16, on *Strix v. varia*, Jan. 27, and on the Mexican bird *Calocitta f. formosa*, March 21. — FLORIDA (recorded by Johnson, 1895, 1913): Lemon City, Dade Co. (E.J. Brown); Gainesville, Alachua Co., on *Haliaeetus l. leucocephalus* (T.H. Hubbell); Sanford, Seminole Co., (F.M. Uhler); Elfers, Pasco Co., May 13 (W.G. Fargo); White City, St. Lucie Co. (C.J. Nielson); Eau Gallie, Brevard Co., on *Otus asio floridanus*, May 9, and *Strix varia georgica*, March 17 (W.W. Worthington); Gainesville, Alachua Co., on *Strix varia georgica*, Dec. 27 (T.H. Hubbell); Miami, Dade Co., on *Bubo v. virginianus*, March 28 (P. Laurent); Paradise Key, Dade Co., on *Strix varia georgica*, Feb. (W.S. Brooks); St. Augustine, St. Johns Co., on *Otus asio floridanus* (C.W. Johnson); Brooksville, Hernando Co., on young *Otus asio floridanus*, June 26 (L. von Borowsky); Bradenton, Manatee Co., on *Otus asio floridanus*, Jan. 20 (A. Wetmore); Merritt's I., Brevard Co., on *Bubo v. virginianus*, Dec. 29 (D.J. Nicholson); Saint Cloud, Osceola Co., on owl, May 30 (F.C. Bishopp). — GEORGIA (recorded by Leach, 1817; Peters, 1936): Brunswick, Glynn Co., on *Strix varia georgica*, March 9 (A.V.J. Clark); Thomasville, Thomas Co., on *Otus a. asio*, Oct. 20 (B.V. Travis); Atlanta, on *Bubo v. virginianus*, Sept. 25 (C. Wharton); Lumber City, Telfair Co., on *Bubo v. virginianus* (C.A. Locke); Beachton, Grady Co., on *Strix varia georgica*, Aug. 2 (E.V. Komarek); Cumberland I., Camden Co., on owl (O.G. Ricketson, Jr.); Oatland I., Chatham Co., on *Buteo jamaicensis borealis* (R.H. McCauley, Jr.); Experiment, Spalding Co., Dec. 6, on hawk (C.M. Beckham); [Cartersville, Bartow Co., on *Accipiter cooperii*; Dalton, Whitfield Co., on *Otus a. asio*; Griffin, Spalding Co., on *Otus a. asio*. — According to P.W. Fattig, *in litt.*; not seen]. — ILLINOIS (recorded by Osten Sacken, 1878; Johnson, 1922; Peters, 1936; MacArthur, 1948): Pike Co., on *Bubo v. virginianus*, July 30 (L.J. Hayden); Waukegan, Lake Co., on *Asio wilsonianus* (W.I. Lyon); Kansas, Edgar Co., on *Accipiter cooperii*, Sept. 14 (W.B. Taber, Jr.); Perry, Pike Co., on owl (C.W. Brown); 2 miles W. of Carterville, Williamson Co., on *Strix v. varia*, Dec. 17 (P.W. Parmalee); Urbana, Champaign Co. (M. James) and on *Bubo v. virginianus* (F. Laznicka); Pana, Christian Co., on *Buteo jamaicensis borealis*, Sept. 1 (P.W. Parmalee); Willow Springs, Cook Co., on *Accipiter cooperii* (F. Laznicka); Hyde Ridge, on *Buteo jamaicensis borealis* (H.L. Stoddard). — INDIANA (recorded by Falcoz, 1930): Indianapolis, on owl; Bedford, Lawrence Co., on *Colinus v. virginianus* (J.J. Davis);

Bluffton, Wells Co., on 2 *Bubo v. virginianus*, Oct. 30, Dec. 22 (E.B. Williamson). — IOWA (recorded by MacArthur, 1948): Ames, Story Co.; McGregor, Clayton Co. (T. Pope); Iowa City (H.F. Wickham; L. Buchanan), on *Otus asio naevius*, Dec. 1, and *Bonasa u. umbellus*, Nov. 9 (H.R. Dill), on *Corvus b. brachyrhynchos*, Nov. 24 (A. Bailey), and on *Bubo v. virginianus* (H.W. Lindsey); Keokuk, Lee Co., on *Otus asio naevius* (J.M. Scheller). — KANSAS (recorded by Snow and Adams, 1903): Franklin Co. (W. Clanton) and on *Buteo jamaicensis borealis* (H.K. Gloyd); Meade Co. (C.W. Hibbard); Douglas Co., on *Bubo v. virginianus* (F.H. Snow); Clay Co. (L.D. Anderson); Riley Co. (E.A. Popenoe). — KENTUCKY (recorded by Swenk, 1916): Louisville, Jefferson Co. — LOUISIANA: Alexandria, Rapides Parish, Sept. 14 (C.R. Jones and R.A. Cushman); Kilbourne, West Carroll Parish, on *Strix varia georgica*, Nov. 8 (W.W. Wirth); Ruston, Lincoln Parish, on Man (W.W. Wirth); Crowley, Franklin Parish, on *Strix varia georgica*, Nov. 3 (G. Lowrey); Natchitoches, Natchitoches Parish, on owl, Nov. 28 (E. Herrick); Camp Salmen, Slidell, Saint Tammany Parish, on *Otus asio floridanus*, Oct. 28 (T. Hall, Jr.). — MAINE (recorded by Johnson, 1925; Procter, 1938, 1946): without precise locality, on *Bonasa umbellus togata*; Portland, Cumberland Co., on *Buteo jamaicensis borealis* (A.G. Johnson); Kittery Point, York Co., on *Accipiter cooperii* (R. Thaxter); Dryden, Franklin Co., on *Colinus v. virginianus*, Oct. 21 (G.H. Heinrich); Oxford Co., on *Dryocopus pileatus abieticola* (F.A. Hartman). — MARYLAND (recorded by Peters, 1936): Accokeek, Prince Georges Co., on *Bubo v. virginianus*, Oct. 13 (W.H. Coleman); Plummers I., Montgomery Co., on *Accipiter cooperii*, March 16 (E.A. Chapin); Sandy Spring, Montgomery Co., on *Strix v. varia* (A.K. Fisher); Beltsville, Prince Georges Co., on *Buteo jamaicensis borealis* (R.T. Mitchell); Baltimore, on *Accipiter cooperii* (J. Thompson); Laurel, Prince Georges Co., on *Buteo l. lineatus*, July 5, and *Accipiter striatus velox*, Feb. 19 (E.B. Marshall), and on *Bubo v. virginianus*, Dec. 29 (F.C. Bishopp); Patuxent Refuge, Bowie, Prince Georges Co., on *Buteo jamaicensis borealis*, *Bubo v. virginianus*, March 15, *Strix v. varia*, and *Accipiter cooperii*, Oct. 26 (R.T. Mitchell); Rockville, Montgomery Co., on *Bubo v. virginianus*, July 21, and *Colinus v. virginianus*, Dec. 27 (C.R. Aschemeyer); Elliott I., on *Corvus ossifragus* (R.E. Stewart); Morgantown, Charles Co., on *Strix v. varia*, Sept. 12 (E.B. Marshall); Port Republic, Calvert Co., on *Bubo v. virginianus*, June 20 (G.F. Gravatt); Gaithersburg, Montgomery Co., on *Bubo v. virginianus*, Feb. 15 (Alva Nye); Bethesda, Montgomery Co., on hawk

(W.H.W. Komp); Burtonsville, Montgomery Co., on *Accipiter cooperii* (E.B. Marshall); Blackwater Refuge, Dorchester Co., on *Buteo jamaicensis borealis*, Nov. 9. — MASSACHUSETTS (recorded by Harris, 1835; Packard, 1869; Johnson, 1922, 1925, 1929; Peters, 1936; Herman, 1937): Princeton, Worcester Co., on *Bonasa u. umbellus* (J.D. Smith); Ware, Hampshire Co., on *Phasianus colchicus* (S. Pilch); Dover, Norfolk Co., on *Bubo v. virginianus* (A.P. Morse); Wellfleet, Barnstable Co., on *Bubo v. virginianus* (R.P. Dow); Wenham, Essex Co., on 2 *Bubo v. virginianus*, Sept. 28 and Dec. 2 (J.C. Phillips); West Springfield, Hampden Co., on *Bonasa u. umbellus*; Ayer, Middlesex Co., on *Accipiter gentilis atricapillus* (J. Peters); Monterey, Berkshire Co., on *Bonasa u. umbellus*; Amherst, Hampshire Co., on *Bonasa u. umbellus* and *Phasianus colchicus* (C.P. Alexander); Paxton, Worcester Co., on *Bonasa u. umbellus* (C.H. Sparrell); Greenfield, Franklin Co., on *Bonasa u. umbellus* and *Bubo v. virginianus* (C.P. Alexander); Wayland, Middlesex Co., on *Bubo v. virginianus* (S. Helleigh); South Hadley, Hampshire Co., on *Bubo v. virginianus* (Elizabeth M. Boyd); Chilmark, Dukes Co., on *Buteo jamaicensis borealis* (G.D. Eustis); Lenox, Berkshire Co., on *Bubo v. virginianus*, Aug. (F.C. Bishopp); Gloucester, Essex Co., on *Haliaeetus l. leucocephalus*, Nov. 4 (E. Birdseye); North Eastham, Barnstable Co., on *Bubo v. virginianus* (C.M. Herman); Harvard, Worcester Co., on *Bubo v. virginianus* and *Strix v. varia* (J. Peters); Boston, on *Buteo l. lineatus*, Aug. 13; Middleboro, Plymouth Co., on *Circus cyaneus hudsonius* (E.H. Forbush); Martha's Vineyard, on *Accipiter cooperii* and *Buteo jamaicensis borealis* (Cleveland); Cohasset, Norfolk Co., on *Strix v. varia*, Nov. 28 (J.S. Brown); West Tisbury, Dukes Co., on *Accipiter striatus velox*, May 31 (A. Keniston); Framingham, Middlesex Co., on *Strix v. varia*, Nov. 1; Sherborn, Middlesex Co., on *Buteo l. lineatus* (A.P. Morse); Petersham, Worcester Co., trapped on fly paper, July, 1946 (C.T. Brues); Chicopee, Hampden Co.; Fall River, Bristol Co. — MICHIGAN (recorded by MacArthur, 1948): Vicksburg, Kalamazoo Co., on *Bubo v. virginianus* (F.W. Rapp); Ann Arbor, Washtenaw Co., on *Bubo v. virginianus*, Nov. 13 (C.C. Adams); Haslett, Ingham Co., on *Bubo v. virginianus* (F. Palmerlee); Union City, Branch Co., on *Bubo v. virginianus* (C.W. Hill); Grosse Isle, Wayne Co., Aug. 27; Jackson, Jackson Co., on *Bubo v. virginianus* (W.C. Fargo); Hastings, Barry Co., supposedly on a squirrel (W.C. Laubaugh); Base Lake, Washtenaw Co., on *Strix v. varia* (W.L. Conkle); Augusta, Kalamazoo Co., on *Bubo v. virginianus*; Ypsilanti, Washtenaw Co., on *Strix v. varia*; Cascade Glen, Ann Arbor,

Washtenaw Co. (T.H. Hubbell); Laingsburg, Shiawassee Co., on *Buteo l. lineatus* (Sherizer); Independence Lake, Washtenaw Co., on *Bubo v. virginianus*; E. S. George Reserve, Livingston Co., on *Accipiter cooperii*; Lima, Washtenaw Co., on owl (W. Blair). — MINNESOTA (recorded by Washburn, 1905; Green and Shillinger, 1935; MacArthur, 1948): Elk River, Sherburne Co., 45° 20' N., on *Accipiter cooperii*, Aug. 8 (B. Bailey); Dodge Co., 44° N., on *Bubo v. virginianus*, May 10 (G. Swanson); Shakopee, Scott Co., 49° 20' N., on *Strix v. varia* (G. Swanson); St. Anthony Park, near Minneapolis, on *Strix v. varia*; Minneapolis, on *Strix v. varia*; Olmsted Co., 44° N.; Hennepin Co., 45° N. (O.W. Oestlund). — MISSISSIPPI: Old River Lake, on 2 *Buteo p. platypterus*, Aug. 24 and Nov. 20 (M.G. Vaiden); Picayune, Pearl River Co., on wild *Meleagris gallopavo silvestris*, Feb., 1926 (J.A. McLemore; through A. Stone); Rosedale, Bolivar Co., on *Accipiter cooperii* (M.G. Vaiden); Laurel, Jones Co., on *Otus a. asio* (G.L. Bond); Oxford, Lafayette Co., on *Buteo jamaicensis borealis* (F.M. Hull); Kossuth, Alcorn Co., on *Bubo v. virginianus*; Agricultural College, Oktibbeha Co., on *Strix varia georgica*; Waynesboro, Wayne Co., on hawk. — MISSOURI: St. Louis, on hawk, probably *Buteo jamaicensis borealis* (C.C. Magrath); Fulton, Callaway Co., on *Colinus v. virginianus* (G.W. Thomas). — NEBRASKA (recorded by Swenk, 1916): Westpoint, Cuming Co., on *Buteo lagopus sancti-johannis* (L. Bruner); Brownville, Nemaha Co., on *Bubo v. virginianus*. — NEVADA: without precise locality (Ac.Nat.Sci.Phila.). — NEW HAMPSHIRE (recorded by Johnson, 1922, 1929; Peters, 1936): Durham, Strafford Co., on *Strix v. varia* (J.G. Conklin); Sandwich, Carroll Co., on *Buteo p. platypterus* (R.G. Carpenter); Washington, Sullivan Co., on *Bonasa u. umbellus* (R.G. Carpenter); Keene, Cheshire Co., on *Bonasa u. umbellus*, March 30 (L.R. Nelson); East Westmoreland, Cheshire Co., on *Bonasa u. umbellus* (L.O. Shelley); Newmarket, Rockingham Co., on *Bonasa u. umbellus* (J. Moffit); Hampton, Rockingham Co., on hawk, *Bubo v. virginianus* and *Asio wilsonianus*, Apr. 9 (S.A. Shaw); Candia, Rockingham Co., on *Accipiter cooperii* (C.L. Hathaway); Windsor, Windsor Co., Nov. 6, on *Bonasa u. umbellus* (H.R. Siegler). — NEW JERSEY (recorded by Johnson, 1900, 1910): Andover, Sussex Co., on *Accipiter striatus velox*, Oct. 4; Ramsey, Bergen Co. (C.E. Sleight); Chester, Morris Co., on *Asio wilsonianus* (J. Assmuth); North Hackensack, Bergen Co., on *Accipiter gentilis atricapillus* (W.DeW. Miller); Medford, Burlington Co.; Stone Harbor, Cape May Co.; Stag Lake, Sussex Co., on *Buteo jamaicensis borealis*, Oct. 10 (W.L. McAtee; W. DeW. Miller); Milton, Morris

Co., on *Strix v. varia*; Boonton, Morris Co., on *Bubo v. virginianus* (T.D. Carter); Haddonfield, Camden Co., on *Bubo v. virginianus* and *Buteo jamaicensis borealis* (C.W. Johnson); Kittatinny Mts., Sussex Co., on *Aquila chrysaetos canadensis* and *Otus asio naevius* (C.W. Johnson).—NEW YORK (recorded by Davis, 1922; Johannsen, 1928; Peters, 1936): near New York City, on 2 *Bubo v. virginianus* (E.E. Wehr; D.L. Coffin); Staten Island, Nov. 24 (W.T. Davis); Long Island, on *Buteo jamaicensis borealis*; Orient Point, Long Island, on *Buteo jamaicensis borealis*, Dec. 16 (F.M. Schott); Coeymans, Albany Co., on *Bubo v. virginianus*; Freeport, Long Island, on *Circus cyaneus hudsonius*, Sept. 13 (H. Thurston); White Plains, Westchester Co., on *Zonotrichia albicollis* (Calvin Farley); Heckscher State Park near Islip, Suffolk Co., on *Falco c. columbarius*, Apr. 8 (R.V. Nardy); Yankee Lake, Wurtsboro, Sullivan Co., on *Buteo p. platypterus*, Sept. 6 (J.P. Chapin); Taganie, Ithaca, Tompkins Co., on *Bubo v. virginianus*, Nov. 1 (L.A. Fuertes); Robin's I., Peconic Bay, Suffolk Co., on 3 of 6 *Phasianus colchicus* examined (L.R. Penner); Austerlitz, Columbia Co., on *Bonasa u. umbellus*, Oct. 23 (H. Thurston); West Point, Orange Co., on *Bonasa u. umbellus*, Nov. 3, and *Accipiter gentilis atricapillus*, Oct. 26 (W. Robinson); Clarksville, Albany Co., on *Bubo v. virginianus*, Oct. 5 (R. Matheson); Altamont, Albany Co., on *Bonasa u. umbellus* and 95 specimens on one *Bubo v. virginianus* (A. Paladin); East Greenbush, Rensselaer Co., on *Strix v. varia*; Honeoye Lake, Ontario Co., on *Haliaeetus l. leucocephalus*, Sept. 17 (R.L. Post); Chatham, Columbia Co.; Rushford, Allegany Co., on *Bonasa u. umbellus* (L.L. Pechuman); Baldwinsville, Onondaga Co., on *Bubo v. virginianus*, Dec. 21 (A.G. Whitney); North Lansing, Tompkins Co., on *Bubo v. virginianus* (W. Middlekauff); Morton, Orleans Co., on *Bubo v. virginianus*, Jan. (F.C. Bishopp); Ellis Hollow near Ithaca, Tompkins Co., on *Bubo v. virginianus*, Aug. 28 (C.E. Palm); Ithaca, Tompkins Co., on *Accipiter cooperii*, Oct. 31 (W.J. Hamilton), on *Bubo v. virginianus*, Oct. 26, 2 *Bonasa u. umbellus*, Nov. 15 and Oct. 1, and *Phasianus colchicus*, Oct. 17 (H.H. Schwardt), and on *Buteo l. lineatus*, Sept. 16 (M.D. Pirnie); Waterburg, S. of Trumansburg, Tompkins Co., on *Bubo v. virginianus*, Nov. 3 (G.W.P. Lassmann); Utica, Oneida Co., on *Colinus v. virginianus*, Nov. 3; Marathon, Cortland Co., on *Bubo v. virginianus*, Sept. 21, *Phasianus colchicus*, and *Buteo l. lineatus*, July 14 (F.C. Goble); Buffalo, on *Bubo v. virginianus* (W. Wild); Orient, Long Island, on *Bubo v. virginianus*, Jan. 1, and *Accipiter striatus velox*, Dec. 7 (R. Latham); Albany, on *Strix v. varia* and *Bubo v. virginianus*, Oct. 24 (D. Stoner); Wells-

ville, Allegany Co., on *Bonasa u. umbellus*, Nov. 6 (Wilson); Noyack, Long Island, on *Bubo v. virginianus*, Jan. 20 (W.M. Evarett); Kotonah, Westchester Co., on *Corvus b. brachyrhynchos*; Stamford, Delaware Co., on *Bonasa u. umbellus*, Oct. 26 (E. Finegan); Rensselaerville, Albany Co., on *Accipiter cooperii* (E.J. Gerberg); McLean Bogs near Ithaca, Tompkins Co., on *Asio wilsonianus*, Nov. 27; Carmel, Putnam Co.; Sparta, Livingston Co., on *Bonasa u. umbellus*, Dec. (R. Matheson). [According to E.K. LeDune, in litt., *L. americana* was taken in 1934–1936 on *Bonasa u. umbellus* in the following counties: Chemung, Westchester, Albany, Allegany, Chenango, Delaware, Essex, Jefferson, Lewis, and Tompkins]. — NORTH CAROLINA (recorded by Peters, 1936; Brimley, 1938): Raleigh, Wake Co., on 2 *Bubo v. virginianus* (C.S. Brimley; Z.P. Metcalf), on *Otus a. asio* (Mrs. R.C. Simpson), on 2 *Strix v. varia*, Dec. 4 (C.S. Brimley; Mrs. R.C. Simpson), on *Buteo jamaicensis borealis* (Mrs. R.C. Simpson), on 2 *Buteo l. lineatus* (Mrs. R.C. Simpson; R. Collie), on *Buteo p. platypterus* (Mrs. R.C. Simpson), and on *Accipiter striatus velox* and *Accipiter cooperii* (C.S. Brimley); Craggy Mt., Buncombe Co., on hawk (H.B. Teague); Pisgah National Forest, in western section, on *Buteo jamaicensis borealis*, Dec. 5 (F.C. Bishopp); Morehead City, Carteret Co., on “hen hawk” (Miss G. Oaksmith); Burlington, Alamance Co., on “chicken hawk”; Johnston Co., on *Pandion haliaetus carolinensis* (Mrs. R.C. Simpson); Wake Co., on *Accipiter cooperii* (J. Dermid); Wilmington, New Hanover Co., on *Strix v. varia*, Nov. 22 (M. Kisliuk); Brunswick Co., on *Buteo jamaicensis borealis* (Mrs. R.C. Simpson); Mt. Olive, Wayne Co., on *Buteo l. lineatus* (Mrs. R.C. Simpson); Onslow Co., on *Strix v. varia* (H.T. Davis); Roxboro, Person Co., on *Bubo v. virginianus* (Mrs. R.C. Simpson); McFarlan, Anson Co., on *Bubo v. virginianus* (Mrs. R.C. Simpson); Worthville, Randolph Co., on *Colinus v. virginianus*, Jan. 3 (P.V. Carpenter); Cameron, Moore Co., on *Buteo jamaicensis borealis*, July 11 (W.F. Douglas); Hoffman, Richmond Co., on *Bubo v. virginianus* (Mrs. R.C. Simpson); Big Cave, Cherokee Reservation, Swain Co., on *Buteo jamaicensis borealis* (A. Stupka); Alamance Co., on *Bubo v. virginianus* (A. Breckenridge); Fuquay, Wake Co., on *Buteo jamaicensis borealis* (F.B. Meachan); Nantahala National Forest, Macon Co., June 23 (W.H. Ball); Durham, Durham Co., on *Buteo jamaicensis borealis*, Nov. 13 (R.E. Lee), and on wild *Meleagris gallopavo silvestris*, Dec. 15, 1944 (D.W. Carter; through A. Stone); Roxobel, Bertie Co., on “hoot owl”; Greensboro, Guilford Co., on domestic chicken. — NORTH DAKOTA: Devils Lake, Ramsey Co., 48° 10' N., on 2 *Buteo jamaicensis calurus* (T.H.

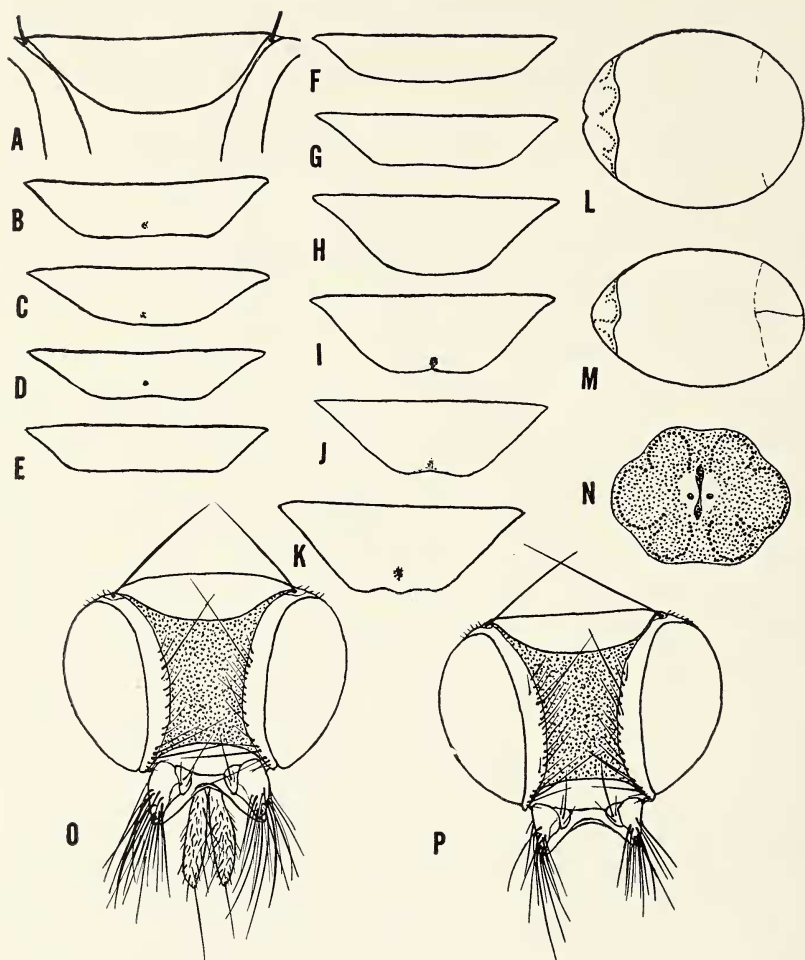


Fig. 53. *Lynchia americana* (Leach). A-K, outline of postvertex: A, Leach's ♀, holotype; B, ♀, Kittatinny Mts., N.J., on *Aquila chrysaetos canadensis*; C, ♀, Wisconsin, on *Bonasa u. umbellus*; D, ♀, on *Meleagris gallopavo silvestris*; E, ♀, Raleigh, N.C., on *Bubo v. virginianus*; F-H, 3 ♀, Ellis Hollow, N.Y., on *Bubo v. virginianus*; I, ♀, California; J, ♀, Tigard, Ore., on *Otus asio brewsteri*; K, ♂, Sa. Cruz de la Sierra, Bolivia, on *Glaucidium b. brasili-anum*; L-N, puparium, Ontario, from above (L), and in side view (M) and respiratory lobes (N); O, head, ♀, Clarksville, N.Y., on *Bubo v. virginianus*; P, head, ♂, Ontario, on *Bubo v. virginianus*.

Hubbell). — OHIO (recorded by Peters, 1936) : without precise locality, on *Bubo v. virginianus*, Dec. 2; Franklin Co., on *Accipiter cooperii* (J. Dusi); Senecaville, Guernsey Co.; Paulding Co., on *Tyto alba pratincola* (O.E. Ehrhard); Cuyahoga Co., on hawk (T.H. Parks); Cleveland, on *Strix v. varia*, Aug. 22 (F.C. Bishopp); Greenville, Darke Co., on *Bubo v. virginianus* (R. Rausch); Columbus, Franklin Co., on *Strix v. varia* and *Accipiter cooperii* (R.M. Goslin); Leetonia, Columbiana Co., on *Accipiter striatus velox* (F.C. Bishopp); Hammondsville, Jefferson Co., on *Bubo v. virginianus* (J.S. Barnes); Marietta, Washington Co., on *Buteo jamaicensis borealis* (G. Link); Youngstown, Mahoning Co., on *Buteo jamaicensis borealis* (G. Link); Glouster, Athens Co., on *Accipiter cooperii*, Nov. 26 (B.G. Swartz); Mohican State Park, Loudonville, Ashland Co., on *Buteo jamaicensis borealis* (F.J. Ligas); Morrow Co., on *Accipiter cooperii* (E.S. Thomas); Buckeye Lake, Fairfield Co., on a nestling *Accipiter cooperii*, June 25 (R. Franks), on *Buteo jamaicensis borealis* (C.F. Walker), and on *Strix v. varia* (R.M. Goslin); Licking Co., on *Bubo v. virginianus*, Oct. 15 (F.H. Smith); Crestline, Crawford Co.; Wauseon, Fulton Co.; Mt. Gilead, Morrow Co., on *Buteo jamaicensis borealis* (G. Thompson); Wilmington, Clinton Co., on *Accipiter cooperii* (C.F. Walker); Grafton, Lorain Co., on *Bubo v. virginianus*; Danville, Knox Co., on *Accipiter striatus velox*; Galion, Crawford Co., on *Bubo v. virginianus* (E.S. Thomas and C.F. Walker); McConnelsville, Morgan Co., on *Bubo v. virginianus* (C.F. Walker); Hillsboro, Highland Co., on *Bubo v. virginianus* (E.S. Thomas, R. Goslin and A. Stupka); Tar Hollow, Ross Co., (G.S. Cowl); Freedom, Portage Co., on *Accipiter cooperii*, Nov. 4 (F.C. Bishopp); Marysville, Union Co., on *Bubo v. virginianus* (R. Rausch). — OREGON (recorded by Cole and Lovett, 1921; Falcoz, 1930) : Corvallis, Benton Co., on *Otus asio kennicottii* (I.N. Gabrielson), and 2 *Bubo virginianus saturatus* (J.W. Jarvis; W.J. Chamberlin); Lebanon, Linn Co., on *Bubo virginianus pacificus*, Nov. (W.J. Chamberlin); Shedd, Linn Co., (W.J. Chamberlin); Illahe, Curry Co., on *Otus asio brewsteri* (L. Miller); Maupin, Wasco Co., on *Otus asio macfarlanei* (S. G. Jewett); Salem, Marion Co. (J. Harrington); Roseburg, Douglas Co. (G.B. Thompson); Adel, Lake Co., on *Bubo virginianus pacificus*, May 19 (A. Walker); Gold Hill, Jackson Co. (C.R. Biederman); Tigard, Washington Co., on *Otus asio brewsteri* (J.E. Davis). — PENNSYLVANIA (recorded by Johnson, 1929; Peters, 1933, 1936; Champlain, 1947) : without precise locality, on *Accipiter gentilis atricapillus* (R. Fricke), and on *Buteo jamaicensis borealis* and *Bubo v. virginianus* (M. Wood); Wilkin-

son, Lawrence Co., on *Otus asio naevius* (H.D. Kirk); Reading, Berks Co., on *Otus asio naevius*, Dec. 3 (T.E. Winecoff), and on *Accipiter cooperii* and *Phasianus colchicus* (L.S. Dillon); Elk Co., on *Accipiter gentilis atricapillus*, Apr. 16 (F.C. Bishopp); State College, Centre Co. (L.S. Dillon); Lackawanna Co., on *Accipiter gentilis atricapillus* (Wilson); Delaware Co., on *Buteo jamaicensis borealis*; Chester, Delaware Co., on *Buteo p. platypterus*; Meckville, Berks Co., on *Buteo jamaicensis borealis* (L.S. Dillon); Stony Creek, Berks Co. (L.S. Dillon); Hawk Mountain, Berks Co., on *Buteo p. platypterus* (L.S. Dillon); Bernville, Berks Co., on *Circus cyaneus hudsonius* (L.S. Dillon); Newton, Mifflin Co., on *Buteo jamaicensis borealis* (L.S. Dillon); Berks Co., on *Buteo p. platypterus* (L.S. Dillon); Fisherville, Dauphin Co., on *Asio wilsonianus* (L.S. Dillon); Exeter Township, Berks Co., on *Accipiter gentilis atricapillus* (L.S. Dillon); Fricke Park, Pittsburgh, on *Accipiter cooperii* (W.L. Black); Clinton Co., on *Bubo v. virginianus* (G. Link); Butler, Butler Co., on *Bubo v. virginianus* (G. Link); Washington Co., on *Aquila chrysaetos canadensis*; Titusville, Crawford Co., on *Bonasa u. umbellus* (H. Roslund); Hartstown, Crawford Co., on *Casmerodius albus egretta*, with *Mallophaga* attached (W.E.C. Todd) and on *Asio wilsonianus* (G. Netting); Allegheny Co., on *Phasianus colchicus* (A. Miller) and *Colinus v. virginianus* (G. Link); Bellows-ville near Vanport, Beaver Co., on *Buteo jamaicensis borealis* (W.E.C. Todd); New Kensington, West Moreland Co., on *Accipiter cooperii* (R. Fricke); Wallingford, Delaware Co. (R.M. Stabler); Mt. Lebanon, Allegheny Co., on *Bubo v. virginianus* (J. Guilday); Frankford, Philadelphia Co., on owl (L.O. Davis); Sherrett, Armstrong Co., on *Buteo jamaicensis borealis*; Pittsburgh, an *Asio wilsonianus*; Pike Co. (P. Laurent); Pocona Lake, Monroe Co., on *Accipiter gentilis atricapillus*; Spruce Creek, Centre Co., on *Bubo v. virginianus*; Waynesburg, Greene Co., on *Bubo v. virginianus*; Scranton, Lackawanna Co. on *Phasianus colchicus* and *Bubo v. virginianus* (Everhart); Cumberland Co., on *Strix v. varia* (J.N. Knull); Dauphin Co. (T.E. Winecoff), and on *Buteo jamaicensis borealis* (C.W. Johnson); Philadelphia, on *Buteo jamaicensis borealis* (C.W. Johnson); Esheol, Perry Co.; Penfield, Clearfield Co.; Shirleysburg, Huntingdon Co.; Harrisburg, Dauphin Co. — RHODE ISLAND: Wakefield, Washington Co., on *Asio wilsonianus* (E.L. Coman); Kingston, Washington Co. (H. Knutson). — SOUTH CAROLINA (recorded by Howard, 1883; Johnson, 1925; Peters, 1936): Sheldon, Beaufort Co., on owl; Greenwood, Greenwood Co., on *Otus a. asio*, Nov. 28 (J.G. Watts); Santee Club, Charles-

ton Co., on wild *Meleagris gallopavo silvestris* (W.L. McAtee); Cordesville, Berkeley Co., on *Aquila chrysaëtos canadensis*, Feb. 25 (F.C. Bishopp); Clemson College, Oconee Co., on *Bubo v. virginianus*, Dec. 2, and *Buteo l. lineatus* (D. Dunavan); Society Hill, Darlington Co., on *Bubo v. virginianus*; Charleston, Charleston Co., on *Bubo v. virginianus*, March 30 (J. Akhurst), and on *Accipiter striatus velox*, *Circus cyaneus hudsonius*, Jan. 11, and *Falco peregrinus anatum*, Nov. 7 (F.C. Bishopp); Summerville, Dorchester Co., on 2 *Otus a. asio*, Feb. 7 and Sept. 26 (W.P. Wharton); Port Royal, Beaufort Co. (E.S. Prevost); Pomaria, Newberry Co., on *Bubo v. virginianus* (F. Sherman); Dewees I., Charleston Co., on *Bubo v. virginianus* (E.K. Moore). — TENNESSEE (recorded by Laskey, 1941): without precise locality, on *Colinus v. virginianus* (R.S. Walker); Elkmont, Sevier Co., on *Bubo v. virginianus* (A. Stupka); Knoxville, Knox Co. (A.C. Cole); White House, Robertson Co., on *Bubo v. virginianus* (Mrs. A.R. Laskey); Dudley Creek, Great Smoky Mts. Nat. Pk., on *Bubo v. virginianus* (A. Stupka); Nashville, Davidson Co., on *Accipiter cooperii*, Aug. 26, *Aegolius a. acadicus*, *Corvus b. brachyrhynchos*, *Buteo jamaicensis borealis*, and *Otus asio naevius* (Mrs. A.R. Laskey); Clarksville, Montgomery Co., Oct. 18, on hawk; Scotts Hill, Henderson Co., on owl, Oct. (Mrs. N.L. Goff); Craggie Hope, Cheatham Co., on *Bubo v. virginianus* (Mrs. A.R. Laskey). — TEXAS (recorded by Osten Sacken, 1878; Johnson, 1922): without precise locality, on *Buteo p. platypterus* (G.H. Ragsdale); Dallas, Dallas Co. (J. Boll); 5 miles N.E. of Nacogdoches, Nacogdoches Co., on *Otus a. asio*, May 3 (H.E. Broadbooks); Eagle Lake, Colorado Co., on *Buteo l. lineatus* (R.H. Baker); 6 mi. E. of Carthage, Panola Co., on *Strix varia georgica* (P.W. Parmalee). — VERMONT (recorded by Johnson, 1922): without precise locality, on *Accipiter striatus velox*; Dunmore Lake, Addison Co., on *Buteo l. lineatus* (C.E. Brown); Marlboro, Windham Co., on *Bonasa u. umbellus* (J.W. Rehn). — VIRGINIA (recorded by Mosby and Handley, 1943, as *Olfersia* sp.): [Culpeper, Culpeper Co., on *Buteo jamaicensis borealis*, Nov. 15 (R.T. Mitchell, *in litt.*; not seen); George Washington Nat. For., Harrisonburg, Rockingham Co., on *Aquila chrysaëtos canadensis* (T.E. Clarke); Whitetop Mt., Grayson Co. (A. Wetmore); Bush Hill near Franconia, Fairfax Co., on *Buteo l. lineatus*, Nov. 28 (B.G. Gunnell); Nelson Co., on 2 *Accipiter cooperii*, Dec. 28 and Feb. 1, and 2 *Bubo v. virginianus*, Jan. 4 and Aug. 11 (W. Robinson); East Falls Church, Arlington Co., on *Bubo v. virginianus*, Sept. 28 (C. Rohwer); Urbanna, Middlesex Co.; Lorton, Fairfax Co., on *Accipi-*

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ter striatus velox; Thornton River, Shenandoah National Forest, on *Bonasa u. umbellus*, Sept. 26 (A. Wetmore); Emporia, Greenville Co., on wild *Meleagris gallopavo silvestris*, 2 ♀, Aug. 1. 1940 (H.S. Mosby); Amherst, Amherst Co., on *Bonasa u. umbellus*, Jan. 11 (T.P. Jackson). — WASHINGTON (STATE): Wawawai, Whitman Co., on *Otus asio macfarlanei* (F. Rotter) and *Bubo virginianus pacificus* (S.D. Beck); Walla Walla, Walla Walla Co. (Capt. Bendire); Pullman, Whitman Co., on *Bubo virginianus pacificus*, May 11 (G.E. Hudson). — WEST VIRGINIA: without precise locality, on *Bonasa u. umbellus*; Huntington, Cabell Co., on *Bubo v. virginianus* (F. Gilbert); Kingwood, Preston Co., on owl; Morgantown, Monongalia Co., on *Strix v. varia*, Sept. 12 (E.B. Marshall). — WISCONSIN (recorded by van der Wulp, 1867; Gross, 1931; MacArthur, 1948): without precise locality, on *Bonasa u. umbellus* (R. Rausch), and on *Colinus v. virginianus*; Portage, Columbia Co., on *Bubo v. virginianus* (K.P. Schmidt); Madison, Dane Co., on 2 *Bubo v. virginianus* (M. Deusing; E.M. Searls, Nov. 13) and *Strix v. varia* (P.W. Hoffmann); Rusk Co., on *Bonasa u. umbellus*, Sept. 29 (R.S. Dorney); Owen, Clark Co., on *Bonasa u. umbellus*, Oct. 26 (F.R. Zimmerman); Wausau, Marathon Co., on *Bonasa u. umbellus* (W. Knoll); Maiden Rock, Pierce Co.; Prescott, Pierce Co., on hawk; Cedar Grove, Sheboygan Co., on *Accipiter gentilis atricapillus*, Sept. 26, and *Accipiter striatus velox*, Sept. 25 (D.D. Berger), on *Accipiter cooperii* (L. Diederich), and on 2 *Buteo jamaicensis borealis* (L. Diederich; D.D. Berger, Sept. 26); Golden Lake, Jefferson Co., on *Bubo v. virginianus*, Jan. 1 (F.S. Schmidt); Lodi, Columbia Co., on *Bubo v. virginianus* (F. Hammerstrom); W. Spring Green, Sheboygan Co., on *Bubo virginianus wapacuthu* (W.M. Wheeler); Beaver Dam, Dodge Co. (H.L. Snyder); Rothschild, Marathon Co., on *Bonasa u. umbellus*, Oct. (R.J. Dicke); Ripon, Fond du Lac Co., on *Bubo virginianus wapacuthu* (W.M. Wheeler); Poynette, Columbia Co., on *Bubo v. virginianus*, Sept. 29, together with *Ornithoica vicina* (R. Rausch); Ozaukee Co., on *Bubo v. virginianus*, Oct. 31 (R. Boettger); 9 miles W. of Colby, Clark Co., on *Bubo v. virginianus*, Jan. 30 (H.W. and Lorna R. Levi). — An old specimen from the Loew Coll. (Mus. Comp. Zool.), without locality, is labeled "on wild turkey," *Meleagris gallopavo silvestris*.

MEXICO: Patzcuaro, State Michoacan, on owl, possibly *Otus asio* subsp. (P.S. Martin).

REPUBLIC OF HONDURAS: Zamorano, 20 miles from Tegucigalpa, on owl (Mrs. Margie Carr).

COSTA RICA: Turrialba, on hawk (E.W. Laake).

PANAMA: Sa. Clara, Chiriqui Prov., R.P., on *Bubo virginianus mayensis* (Mrs. M.E. McLellan Davidson); Juan Diaz, Panama Prov., R.P. (T. Hallinan).

COLOMBIA (recorded without more precise locality as *O. fusca* by Macquart, 1845): without precise locality at Brit. Mus.; also Macquart's type of *fusca* from Bigot Coll., now in J.E. Collin Coll.

GUIANA (recorded by Falcoz, 1930, probably from French Guiana, as *L. fusca*).

BRAZIL (recorded by Bigot, 1885, as *O. fusciventris*; Bau, 1929, as *O. fusca*; Lutz, Neiva and da Costa Lima, 1915, as *O. nigra*): Santos, State São Paulo, on *Sterna* sp. (Juliani); Butantan, State São Paulo, on *Tyto alba tuidara* (Werner); Ypiranga, State São Paulo, on *Otus c. choliba* and 3 *Tyto alba tuidara* (J. Lima), and on *Pulsatrix perspicillata pulsatrix* (E. Dente); Monte Alegre, State São Paulo, on *Buteo m. magnirostris* (J. Lima); Quilombo, State São Paulo; Presidente Epitacio, State São Paulo (J. Lima); Castra, State Paraná (W. Garbe); Anapolis, State Goyaz, on *Speotyto cunicularia grallaria* (O. Pinto); Itaquí, State Rio Grande do Sul, on *Glaucidium b. brasilianum* (W. Garbe); Maria de Fé, State Minas Gerais, on *Speotyto cunicularia grallaria* (O. Pinto); Joinville near Humboldt, State Santa Catharina, on *Tyto alba tuidara* [recorded by Bequaert, 1943, erroneously as on "*Bubo crassirostris*"] (W. Ehrhardt); Nova Teutonia, Itá, State Santa Catharina, on *Buteo m. magnirostris* (F. Plaumann); City of São Paulo, on *Tyto alba tuidara* (G.A. Allen) [recorded by Bequaert, 1933, erroneously as from San José, California] and on *Rhinoptynx c. clamator* (J. Lima); Guarapuada, Rio Jordão, State Paraná, on *Speotyto cunicularia grallaria*; Cara Pintada, State Paraná, on *Otus c. choliba*; Vermelho, State Paraná, on *Strix hylophila*; Martinho Prado, State São Paulo, on "gavião" or fulvous-bellied kite (B.B. Amaral); Cantareira, State São Paulo, on *Ciccaba virgata borelliana* (L.R. Guimarães); Tabatinguera, State São Paulo.

BOLIVIA: Sa. Cruz de la Sierra, Prov. Sara, on *Glaucidium b. brasilianum* (J. Steinbach); Irupana, 200 Kilom. E. of La Paz, 2000 m., S. Yungas, on *Falco sparverius cinnamominus* (Künzel and Niethammer).

ARGENTINA (recorded by Falcoz, 1930, as *L. fusca*): Deseado, Misiones, on *Columba rufina sylvestris* (S. Pierotti); Misiones (E. Kivirikko); Agua Tapada near Hualfin, Catamarca, on *Caracara p. plancus*, July (S. Pierotti).

L. americana is a common New World fly with many breeding hosts. Massonnat's *Olfersia americana* (1909, p. 304), taken on

Platalea leucorodia in France, was certainly misidentified. Falcoz (1926, p. 31) described it later as a distinct species, *Lynchia massonnati*; but its true identity remains obscure. My attempts to trace the present whereabouts of the specimen have failed. I am inclined to regard it as identical with the African *Lynchia schoutedeni* J. Bequaert (1945b, p. 93).

The discussion of the distribution in Part I (p. 238, as *L. americana* and *L. fusca*) dealt mainly with the seasonal occurrence of the fly, so that some additional remarks are called for. In the Dominion of Canada, *L. americana* is as yet unknown from the western provinces and is rather rare in the East, where it occurs chiefly in southern Ontario. The northmost record ($51^{\circ} 33' \text{ N.}$), dating from Walker (1849), needs confirmation, as all later Canadian captures are from $48^{\circ} 50' \text{ N.}$ or farther south. These later Canadian records fit in with the northmost captures in the United States, particularly in North Dakota and Minnesota, none of which is from north of $48^{\circ} 10' \text{ N.}$ Although there are relatively few records from Mexico and farther south, the species occurs throughout the continental part of the Neotropical Region, as far as 30° S. I have not seen it from the Antilles and there is no reliable record from that area.⁴⁴

Known Nearctic Hosts of *L. americana* (verified individual records in parentheses). Ciconiiformes (1): *Casmerodius albus egrretta* (1). Falconiformes (132 and 10 undetermined hawks): *Accipiter cooperii* (30); *A. gentilis atricapillus* (9); *A. striatus velox* (13); *Aquila chrysaetos canadensis* (4); *Buteo jamaicensis borealis* (40); *B. jamaicensis calurus* (2); *B. lagopus sancti-johannis* (1); *B. l. lineatus* (13); *B. lineatus alleni* (1); *B. p. platypterus* (9); *Circus cyaneus hudsonius* (4); *Falco c. columbarius* (1); *F. peregrinus anatum* (1); *Haliaeetus l. leucocephalus* (3); *Pandion haliaetus carolinensis* (1). Galliformes (82): *Bonasa u. umbellus* (54); *B. umbellus togata* (3); *Colinus v. virginianus* (9); **Gallus gallus bankiva* (1); *Meleagris gallopavo silvestris* (wild; 5); *Pedioecetes phasianellus campestris*; **Phasianus colchicus* (10). Charadriiformes (1): *Uria l. lomvia* (1). Columbiformes (1): *Zenaidura*

⁴⁴ O'Connor and Beatty (1938, Trans. Roy. Soc. Trop. Med. Hyg., London, 31, pt. 4, p. 410) mention *Olfersia americana* as occurring in St. Croix on *Columbigallina passerina nigrirostris*, but almost certainly by error. *L. americana* occurs very rarely on Columbidae and as a stray only. The fly on the *Columbigallina* was probably either *Ornithoctona erythrocephala* or *Microlynchia pusilla*, both of which are known to occur on wild doves in St. Croix.

macroura carolinensis (1). Strigiformes (238 and 17 undetermined owls): *Aegolius a. acadicus* (1); *Asio wilsonianus* (9); *Bubo v. virginianus* (113); *B. virginianus pacificus* (19); *B. virginianus pallescens* (3); *B. virginianus saturatus* (2); *B. virginianus wapacuthu* (3); *Otus a. asio* (7); *O. asio bendirei* (7); *O. asio brewsteri* (2); *O. asio floridanus* (7); *O. asio kennicottii* (1); *O. asio mecalli*; *O. asio marfarlanei* (2); *O. asio naevius* (7); *O. asio quercinus* (3); *Speotyto cunicularia hypugaea* (2); *Strix n. nebulosa* (1); *S. occidentalis caurina* (2); *S. occidentalis lucida* (1); *S. v. varia* (30); *S. varia georgica* (9); *Tyto alba pratincola* (7). Piciformes (1): *Dryocopus pileatus abieticola* (1). Passeriformes (6): **Calocitta f. formosa* (1); *Corvus b. branchyrhynchus* (3); *C. ossifragus* (1); *Zonotrichia albicollis* (1). To the Charadriiformes should be added *Philohela minor*, on which the fly was taken at South Amherst, Massachusetts, Oct. 18 (W.G. Sheldon).

Known Neotropical Hosts of *L. americana*. Falconiformes (4 and 2 undetermined hawks): *Buteo m. magnirostris* (2); *Caracara p. plancus* (1); *Falco sparverius cinnamominus* (1). Charadriiformes (1): *Sterna* sp. (1). Columbiformes (1): *Columba rufina sylvestris* (1). Strigiformes (18 and 2 undetermined owls): *Bubo virginianus mayensis* (1); *Ciccaba virgata borelliana* (1); *Glauucidium b. brasilianum* (2); *Otus c. choliba* (2); *Pulsatrix perspicillata pulsatrix* (1); *Rhinoptynx c. clamator* (1); *Speotyto cunicularia grallaria* (3); *Strix hylophila* (1); *Tyto alba tuidara* (6).

Bionomics. The list of 45 native and 3 introduced New World host species and 518 verified individual records of *L. americana* looks impressive, but gives only a partial idea of the frequency and density of infestation on different types of hosts. It is conclusive enough in showing that only Falconiformes, Galliformes and Strigiformes are true breeding hosts. The few reported occurrences on other types of birds are clearly abnormal and due either to natural straying or, more often, to *post mortem* contaminations. In the Nearctic Region, where the fly is reported from 33 native and 3 introduced host species, 97 per cent of the 490 verified records are from the 3 orders mentioned above. The Strigiformes lead with 52 per cent of the records, followed by the Falconiformes with 28 per cent and the Galliformes with 17 per cent. It should not be concluded from this that birds of prey are more favored as hosts than game birds or that owls are preferred to diurnal Raptores. The many records from owls may be due to the flies being more easily obtained from them than from diurnal birds of prey. The relative paucity of records from game birds is explained by the habit many collectors have of

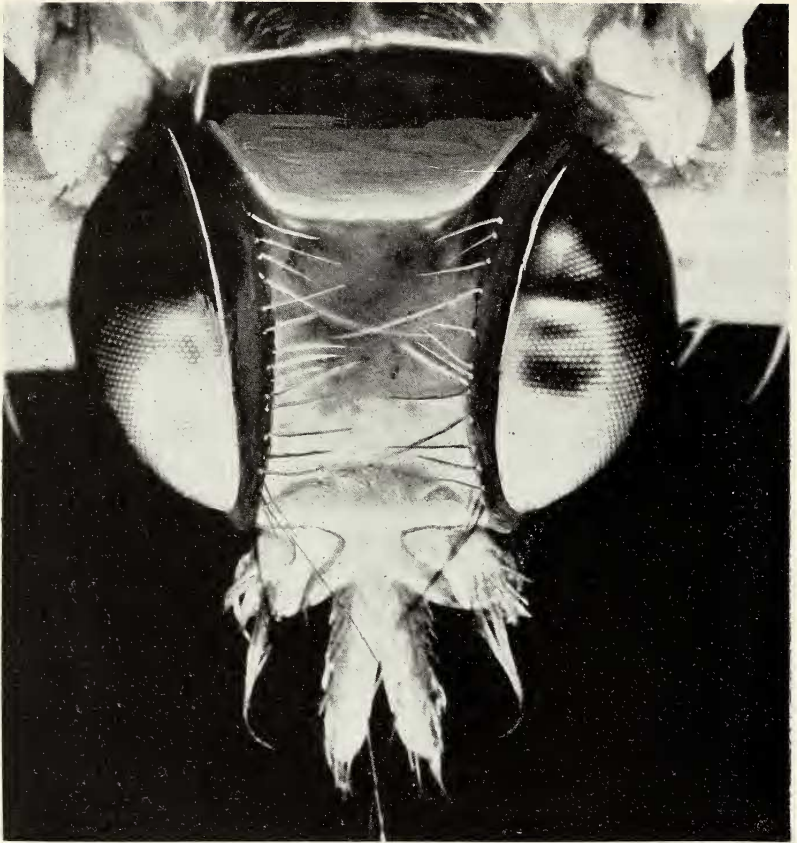


Fig. 54. *Lynchia americana* (Leach), head, ♀. Photograph by Mr. K. MacArthur (1948, fig. 245).

pooling flies from several such birds. The ruffed grouse, *Bonasa umbellus*, is actually as frequently infested as any of the birds of prey and serves, moreover, as an important winter host of the fly (Part I, p. 232). I am indebted to Dr. L. Penner for the following pertinent additional evidence. During October and November, 1951, 1952 and 1953, he found at Tolland, Connecticut, flies on 18 out of 36 ruffed grouse examined, the dates of capture being evenly spaced from Oct. 10 to Nov. 17. He also observed a fly-infested grouse on February 18, 1953. Individual infestations were light on these 19 birds, 10 carrying 1, 5 carrying 2, 3 carrying 3, and 1 carrying 5 flies. I suspect that the wild turkey was at one time and is perhaps

even now an important, regular host of *L. americana*; but the present restricted range and protected status of this bird make the collecting of its ectoparasites difficult. It is also of much interest that the introduced Asiatic pheasant has become a regular, acquired new host of the fly in the eastern United States. Dr. L.R. Penner has furnished the following information on infestation with *L. americana* of pheasant on Robbin's Island (in Greater Peconic Bay), New York. In 1947 the island was considered to have no game birds at all. It was then stocked with some 3000 pheasants. In June, 1951, when Dr. Penner visited it, the remaining adult pheasant population was estimated at some 500 birds. On July 27 and 28 he removed 6 live adult birds to his laboratory in Connecticut, *L. americana* being later found on 3 of them, 1 fly in 2 cases and 2 flies in the third. One of the 4 flies deposited a larva on July 8. As no grouse or quail were present on the island at the time of the visit, Dr. Penner regards the pheasant as the fly's natural host there.

C.W. Johnson (1925c, p. 52) was of the opinion that, in the eastern United States, *L. americana* was primarily a parasite of birds of prey and especially of certain owls, because it is often abundant on such birds. He regarded its occurrence on grouse as more accidental. From the observations recorded above I am inclined to regard native gallinaceous birds as the original hosts, from which owls and diurnal Raptores acquired the fly later by preying on game birds. The reverse process of game birds acquiring a regular fly parasite from their predators seems less probable.

I am also indebted to Dr. L.R. Penner for the following observations on experimental feeding. On October 29, 1952, he fed 7 *L. americana*, taken from two ruffed grouse, on a domestic pigeon. They fed readily, taking less than 5 minutes to engorge. Four flies, kept in vials after being fed on the pigeon, fed a second time. On October 30, 5 of the original 7 flies fed to satiation. Ordinarily the flies had no hesitation in feeding from chambers made for the purpose. Flies left on the pigeon could be located on the under side of the wings; but the pigeons pecked at them and possibly ate some, as not all of the flies were recovered. The body of the fly is tilted forward in feeding, with the hind legs lifting up the rear. The region near the vent of the pigeon was found most suitable for feeding the flies.

The records of *L. americana* from Central and South America are as yet too few to be fully trusted. Nevertheless it may be significant that the majority of Neotropical host species (9 out of 14, with 20 of the 28 individual records) are Strigiformes. That there

are fewer records from diurnal Raptores and none from gallinaceous birds can hardly be fortuitous, as other hippoboscids have been taken in some numbers on such birds in tropical America. Possibly other bird-flies, such as *Lynchia nigra* on Falconiformes and *Olfersia coriacea* on Galliformes, compete more successfully with *L. americana* on these hosts. In line with this, *L. americana* is also rare or lacking on Falconiformes in the western and southern United States, where diurnal Raptores are frequently infested with *L. nigra*, a fly occurring only accidentally in the northeastern states. In this connection it would be worthwhile to investigate the Mexican wild turkey, *Meleagris g. gallopavo* (= *mexicanus*), on which no hippoboscid has been taken thus far.

Although it has sometimes been mentioned in print, the puparium of *L. americana* was thus far undescribed. The following account is based on specimens obtained from flies on owls in California, on *Accipiter cooperii* in Massachusetts, on *Asio wilsonianus* in New Jersey, and on *Bubo v. virginianus* in Ontario, New York, Pennsylvania and South Carolina. When normally developed, it is broadly and almost regularly elliptical, scarcely narrower posteriorly, moderately depressed and equally convex dorsally and ventrally, 4.4 mm. long, 3.2 mm. wide and 2.5 mm. thick (Fig. 53L-N). The hexagonal cap, bearing the polypneustic lobes at the posterior end, has broadly rounded angles and is divided into halves by a very shallow sinus with a deeper, narrow longitudinal groove in the bottom; near each side of this groove a depression bears the minute circular scar of the stigma of the second larval instar. The halves of the cap do not show the usual 3 broad, low, radiating ridges separated by shallow depressions (of *Ornithomyia*, for instance). Instead each half is fairly uniformly and densely covered with minute punctures and bears close to the outer margin three groups of small pores on raised tubercles. The pores of each group form a broad, irregular curve or bow, convex toward the outer margin and ending widely open far from the center of the cap. The remainder of the puparium is bare and shiny, the integument with a close, irregular network of microscopic engraved lines. Traces of transverse segmentation and of lateral depressions running lengthwise are visible in newly-voided larvae, but not in the fully-formed puparium.

The conditions under which the larvae are voided are as yet obscure. It is by no means certain that the puparia are normally found in the feathers of all types of hosts, as Champlain (1947) and others have observed for the great horned owl. The soft, dense plumage of owls offers ideal conditions for sheltering and retaining

hippoboscid puparia; but these conditions are not duplicated by the plumage of diurnal birds of prey and game birds. A *L. americana* taken from the ruffed grouse on October 9, at Princeton, Massachusetts, deposited a larva in the collector's hand (C. W. Johnson, 1929, p. 51). On December 21, 4 ♀♀ and 2 puparia were collected from a great horned owl at Baldwinsville, N. Y. It would appear that in *L. americana* reproduction proceeds normally on certain hosts during late fall and early winter in temperate America, or even the year round where winters are mild.

Aspects of the life-history of *L. americana* (or its synonym, *L. fusca*) discussed in Part I include infestation with mites (pp. 157-158), phoresy of Mallophaga (p. 172), larviposition (p. 194), duration of pupal development (p. 199), interspecific competition on the host (p. 223), seasonal fluctuations (p. 238), and density of populations (p. 232). It is one of the few hippoboscids definitely known as a permanent, year-round member in the adult state of the temperate fauna of North America. It may be taken at all seasons on the 3 orders of birds containing breeding hosts, but is particularly common on owls from November to March. The dates of captures in various areas also show that it is a permanent parasite over most of its geographical range.

Herns and Kadner's experiments with *L. americana* (as *L. fusca*) in the transmission of *Haemoproteus lophortyx* from quail to quail were mentioned in Part I (p. 360). It was pointed out that they had little if any bearing on the transmission of this blood parasite in nature, as *L. americana* has never been taken on wild quail in California, in spite of the many hundreds of hippoboscids collected from these birds. In a recent textbook (1950, p. 414) Herns adds that in captivity "*L. fusca*" feeds readily on quail and deposits mature larvae freely when fed on them. No evidence has been offered thus far that *L. americana* transmits a blood parasite either to ruffed grouse or to any of its other true hosts in nature.

Affinities. My earlier accounts of the larger species of *Lynchia* (1933b, 1945b) recognized *L. fusca* (Macquart) as specifically distinct from *L. americana*, the former believed to occur mainly in western North America and south of the Mexican border and the latter to be restricted to the eastern Nearctic Region. It also seemed at that time that the two forms differed somewhat in host preferences, *L. fusca* being thought to be more specific of owls. Later studies of over 1500 specimens, including several large lots from individual hosts, made it increasingly difficult, however, to distinguish these two forms in all cases. Repeated attempts to find fully reliable

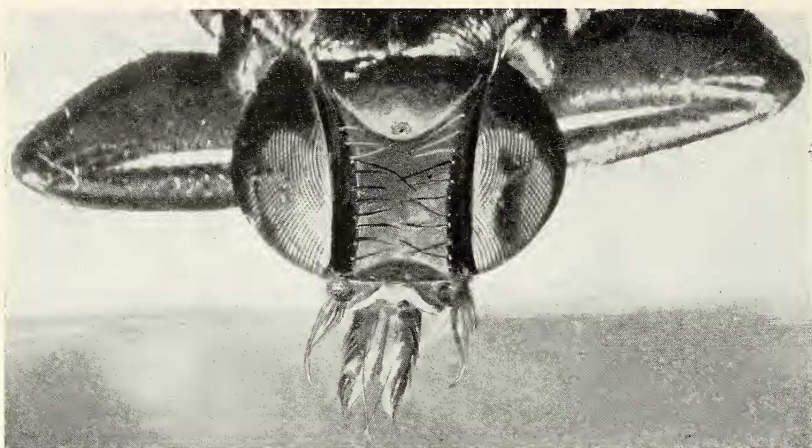


Fig. 55. *Lynchia americana* (Leach), head, ♀, Brooksville, Fla., on *Otus asio floridanus*. Photograph by Mr. K. MacArthur (1948, fig. 246, as *L. fusca*).

specific differences have failed and it now seems impossible to recognize more than one species among the large American *Lynchia* with few orbital bristles placed in a single row and with the interocular face much wider than an eye. It follows that the supposed differences in distribution and host preferences are no longer tenable.⁴⁵

Of the characters formerly believed to separate *L. fusca* and *L. americana*, the shape of the smooth postvertex seemed at first to be most reliable, and the difference between the two extreme types (Fig. 53E and Fig. 53K) is indeed striking. In one the postvertex is transverse, considerably (up to 5 times) wider than long, with a rather straight anterior margin longer than either of the sides. In the other, it is more semi-elliptical, often barely 3 times as wide as long, with a more or less convex anterior margin not, or scarcely, longer than either of the sides. Many flies readily fall in two groups based on this character; but others are clearly transitional. In this connection it may be noted that in Leach's type of *L. americana* the postvertex is about mid-way between the two extremes (Fig. 53A); so that, if two species were recognized by the shape of the postvertex, this type would have to be placed arbitrarily. Moreover, a study of the postvertex in long series from individual hosts, easily obtained

⁴⁵ In Part I of the present work the discussion of various aspects of the natural history of *L. americana* and *L. fusca* was based on the concept that they were distinct species. It should be revised to conform with the new view presented here.

in this species, shows conclusively that the variations in shape are due to individual or fluctuating variability in natural interbreeding populations, hence have no specific or subspecific significance. A series of 61 flies taken from one great horned owl, at Ellis Hollow near Ithaca, by Dr. C. E. Palm (J. Bequaert, 1945a) was particularly instructive, showing all gradations from the transverse to the semi-elliptical type (Fig. 53*F-H*).

It was thought at one time that the shape of the interocular face might be more reliable than that of the postvertex. In my key of 1945 I described *L. americana* with the "inner margins of eyes strongly diverging to the postvertex;" and *L. fusca* with the "inner margins of eyes subparallel or slightly diverging." There are, however, so many seemingly haphazard variations in this respect that the difference is clearly of no specific value. Other possible specific differences, such as the relative length and width of the interocular face, the shape or relative width of the inner orbits, and the presence or absence of an anterior pit (rudimentary ocellar depression) on the postvertex, were also investigated and found unreliable.

The venation appears to be on the whole more stable in *L. americana* than in some other hippoboscids. The 1st longitudinal vein ends in the costa decidedly basad of the anterior cross-vein (Fig. 14*F*; Ferris, 1930c, p. 68, fig. 54). The subcosta varies relatively little, being normally incomplete. In 384 of 397 flies it is incomplete in both wings, either ending abruptly some distance from the costa or fading gradually in the membrane; in 10 flies it is incomplete in one wing and complete to the costa in the other; and in 2 flies it is complete in both wings (1 of 10 flies from one *Accipiter cooperii*, Kittery Point; 1 from *Bubo virginianus pacificus*, Pullman). In one fly, from Delmar, on *Buteo l. lineatus*, the subcosta is incomplete as usual in one wing, while in the other it is connected not with the costa, but with the 1st longitudinal at a point slightly basad of the anterior basal cross-vein.

Apart from the terminalia (Figs. 52*F-G*), there is very little difference between the sexes; but the abdomen of the ♀ bears ventrally a group of long setae bunched on a raised, soft, not sclerotized knob, between the 7th abdominal spiracle and the vulvo-anal sclerites (Fig. 52*F*, *kn*); the ♂ lacks this setigerous knob. In some males the interocular face appears slightly narrower than in most females; but usually the difference is scarcely noticeable (Figs. 53*O-P*). The single antero-median tergal sclerite is present in both sexes and of about the same shape and size.

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Original description of *F. americana* (1817, p. 11): "F. lutescens, thorace angulis anticis in tubercula obtusa productis, alis subiricoloribus. Caput lutescens: oculi atro-nigri: antennae nigricantes: labium album: haustellum luteum: vagina [palpi] picea pilis nigris obtecta: clypeus [frons] subquadratus luteus antice late emarginatus; laciniis divaricatis [apical arms of frons] acuminatis: frons [mediovertex] brunneo-lutea; marginibus elevatis [inner orbits] glaberrimis: vertex [postvertex] elevatus glaberrimus luteus. Thorax subbrunneo-luteus obscurius irregulariter strigosus depressione cruciforme notatus: scutellum subbrunneo-luteum medio impressum: pectus pallidum glabrum medio sulcatum lateribus subcrenulatis, antice bifurcatum; laciniis rotundatis: alae subiricolores: pterigostea [veins] picea et lutea: pedes lutea: tarsi obscuriores: ungues nigri. Abdomen flavo-luteum punctulis nigris sparsum, basi medioque supra obscurius." On p. 6 there is also a brief diagnosis: "Lutescens, thorace angulis anticis in tubercula obtusa productis, alis subiricoloribus." The type, a female from the Francillon Collection, now at the British Museum, was seen in 1933 and again in 1951. It agrees in every respect with my concept of the species, showing the specific characters given in my key. According to a camera lucida sketch by Dr. G. B. Fairchild (Fig. 53A), the postvertex is about 3 times as wide as long, with the convex anterior margin about as long as the sides. Leach gave no measurements; but the right wing of the type is 8.3 mm. long, in agreement with Leach's fig. 1, drawn natural size. The subcosta is incomplete in both wings.

Original description of *H. bubonis* (1869, p. 417, footnote): "Female. Uniform horn color, with a reddish tinge and blackish hairs; legs paler, with dark tarsi; body beneath paler; tip of abdomen black, with long bristles. Length of body .30 inch [= 7.6 mm.]; of a wing .34 inch [= 8.6 mm.]. Differs from *H. equinae* in being larger, and in its uniform reddish color." The type, originally at the Peabody Academy of Sciences in Salem, Massachusetts, is now at the Museum of Comparative Zoölogy. It is in very poor condition, having lost both head and abdomen. There is no doubt, nevertheless, that it is the common *L. americana*, as Osten Sacken (1878) first recognized. The wing is 8 mm. long.

Original description of *O. fusca* (French text translated): "Fusca. Alis fuscans. Long. 2 [French] lines [= 4.5 mm.]. Body entirely brown." It would, of course, be impossible to attempt to recognize the species from this description. Fortunately the type was the property of Bigot (as mentioned by Macquart) and is now in the J. E. Collin Collection. It was first seen by Speiser (1902), whose notes follow (translated from the German): "Length 4.5 mm., from oral margin to hind margin of scutellum 3 mm. Uniformly russet-brown, somewhat shiny, the base of the proboscis beneath and the lower face at the sides of the antennal pits yellowish-brown. Wings smoky-brown. Frons [interocular face] a little wider behind than in front, the inner margins of the eyes therefore not exactly parallel. Occiput evenly rounded; occipital triangle [postvertex] wider, but only about twice as wide as long, with a slight, pit-like, deepened notch in the middle of the anterior margin (difference as compared with *O. macquartii* Rondani). The raised and smooth margins of the eyes [inner orbits] with a deeper impression shortly behind mid-length; in front of this impression stands a seta, as usual in *Olfersia* [= *Lynchia*] and from this a row of punctations runs forward, the whole forming a kind of furrow. Clypeus [frons] short, the upper margin only with a weakly indicated small pit, distinctly divided transversely, the anterior portion ending in two very short diverging points. Maxillary palpi elongate, as long as the anterior width of the frons [interocular face] and somewhat over half the length of the head; slightly curved downward, dark brownish-yellow with blackish-brown lower edge. Thorax rounded, with humeral angles only slightly projecting, a fine longitudinal suture [median notal suture] and a continuous, medially uninterrupted transverse suture [transverse mesonotal suture]. Scutellum of the

usual shape, uniformly russet-brown throughout; the center is damaged, so that nothing can be said about the presence or absence of a furrow. Legs without peculiarities; femora not paler basally than the remainder of the abdomen. Subcostalis [1st longitudinal] ending before [basad of] the small cross-vein [anterior cross-vein]; radialis [2nd longitudinal] ending closer to the cubitalis [3rd longitudinal] than to the subcostalis [1st longitudinal]; last section of costa only half the length of the penultimate, not thickened; posterior [second] basal cell less than half the length of the anterior [first], suddenly widened at the elbow of the discoidalis [4th longitudinal], where it is narrower than its distance from the anterior margin of the wing. Starting point of the discoidalis [4th longitudinal] only slightly raised and knob-like. Abdomen without peculiarities; first segment and sides dark-brown." I examined the type in 1951 and found that it agreed with what I had been calling *L. fusca* since 1933. This had been surmised from Speiser's remarks, particularly his description of the postvertex and of the short row of punctations on the inner orbits, the punctations being the insertions of the smaller orbital bristles. The sex of the type could not be determined. I now no longer recognize *L. fusca* as distinct from *L. americana*.

Original description of *O. rufiventris* (French text translated): "Long. 7 mm. Nigro nitido. Haustello rufo, palpis obscure castaneis; fronte media, spatio quadrato magno, opaco, vertice parum cordiformi, marginibus internis oculorum et epistomate, nitidis; oculis pallide rufis; tergo thoracis et scutello, linea longitudinali media profunde notatis; abdomine rufo pruinoso, macula basali parva, et, apicem versus, maculis duo rotundatis, nigris nitidis picto; pedibus omnino nigris, nitidis; alis infuscatis; vena transversa 2a, vix perspicua, a 1a longe locata. Proboscis russet; palpi dark brown; eyes pale reddish; frons [interocular face] medially with a large dull, quadrangular, depressed area [mediovertex] between the narrow and shiny projections of the inner margins of the orbits and extending from the anteriorly notched vertex [postvertex] to the epistome [frons]; a longitudinal groove over middle of tergum and scutellum [median notal suture]; abdomen russet, pruinose, with a small, black and shiny, projecting spot near the base and two other, larger, rounded, similar spots near the apex; legs entirely shiny black; wings blackish; two basal cells very unequal, the 2nd or inner cross-vein [anterior basal cross-vein] poorly defined and placed close to base of wing; 1st longitudinal vein of Rondani [true 1st longitudinal, not Rondani's] united with the costa basad of 1st or outer cross-vein [anterior cross-vein]; 2nd and 3rd longitudinal veins [2nd and 3rd longitudinals] ending close together, but very far from 1st longitudinal." Originally described from 4 specimens, all now in the J. E. Collin Collection. Speiser (1902) recognized that they belonged in *Lynchia* (Speiser's *Olfersia*), not in *Ornithomyia* as Bigot thought, and were closely related to *O. fusca* Macquart. He believed that *rufiventris* differed from *fusca* in the larger size and in the "contour of the vertex" [postvertex], adding the following remarks (translated from the German): "Length 5.5 to 7.5 mm., from oral margin to hind margin of scutellum 3.5 to 3.75 mm. Color as in *O. fusca* Meq.; only the side corners of the scutellum are somewhat more yellowish-brown than the remainder of the thorax and the reddish middle line is more distinct. The frons [interocular face] is quite parallel-sided, not narrower in front than behind; vertical triangle [postvertex] in this case also with a small pit notching the anterior margin." In 1951 I made a careful study of the 4 types of *rufiventris* and was unable to find a reliable character to separate them from the type of *fusca*, with which I compared them. The apparent difference in size is due mainly to the shrunken abdomen of the type of *fusca*. The body size, moreover, varies within the series of *rufiventris*; but the variation in the length of the wing is well within the limits known for *L. americana* (7 to 8 mm.). The sex of the types of *rufiventris* was not determined.

Original description of *O. macquartii*: "Long. 5 mm. Nigricante-picea:

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proboscide lutescente, basi crassiuscula et in linguam filiformem elongata. Palpi elongati, sub-erecti, nigricantes, sub-conici. Frons [true frons] non distincte foveolata nec punctis impressis signata, labio supra os sub-lutescente: orbitis angustis [inner orbits] et areola verticis [postvertex] levibus nitentibus; area verticale [postvertex] antice in medio incisa et in specimine nostro paulo ferruginante. Thorax in dorso cum scutello nitens. Abdomen nigricans, opacum, nigro-setigerum, lateribus et basi pallidis. Alae fuscae, venis obscure subluteis; abdomine duplo et ultra longiores; vena prima longitudinale [subcosta, not the true 1st longitudinal] contra transversum anteriorem [anterior basal cross-vein]; tertia [2nd longitudinal] in costale satis remota a secunda [1st longitudinal] et proxima quartae [3rd longitudinal]; transversa posteriore [anterior basal cross-vein] dimidiata, non obliqua. Pedes fusci, femoribus basi paulo lurida glaucis." Rondani based his description on a specimen which he had received from Macquart labelled "*O. fusca*," but he believed it was a distinct species, as it did not agree with Macquart's description. According to information kindly supplied by Dr. Benedetto Lanza (*in litt.*, 1953), the type of *O. macquartii* is now in Rondani's collection, preserved in the Natural History Museum at Florence (under No. 3410). So far as I know, it was not examined since it was described. Speiser's incidental remark, in his discussion of *O. fusca* (1902), does not seem to have been based on a study of Rondani's type. It seems most probable that *O. macquartii* was based on a specimen of Macquart's *fusca*; like the latter, it may confidently be placed in the synonymy of *L. americana*.

Lynchia latifacies, new species

Figs. 56A-E

Male. Head (Fig. 56C) in front view about $1\frac{1}{6}$ times as wide across eyes as high from occipital margin to tips of apical arms of frons. Interocular face at its narrowest about $1\frac{3}{4}$ times the width of an eye, nearly as high along inner orbits as its greatest width at postvertex, the sides moderately converging toward lower third. Inner orbits nearly half as wide as mediovertex at its narrowest; inner orbital bristles few, mostly weak: a lower group of 3 or 4 (1 stiff and long) near lunula; an irregular row of 5 or 6 (none very long) at about mid-height of face; 1 stiff, rather short vertical bristle on each side. Postvertex wider than long, though relatively longer than usual, rhombiform; depressed anterior margin slightly wavy, about as long as each side in which it curves gradually; no traces of rudimentary ocelli, but instead a superficial median pit near the center. Frons: lunula and interantennal area separated by a deep, furrowed, transverse suture; lunula with a minute antero-median pit; basal portion of interantennal area broad, nearly as wide as its distance from inner eye margin, nearly as long as lunula; apical emargination very broad, the sides forming 2 short, sharply pointed, but not prong-like arms which reach just beyond the antennae. Antenna short: 1st segment almost completely fused with side of lunula, bearing a few short setae; 2nd segment twice as long as 1st along inner margin, very broadly rounded at apex, with 6 to 8 long,

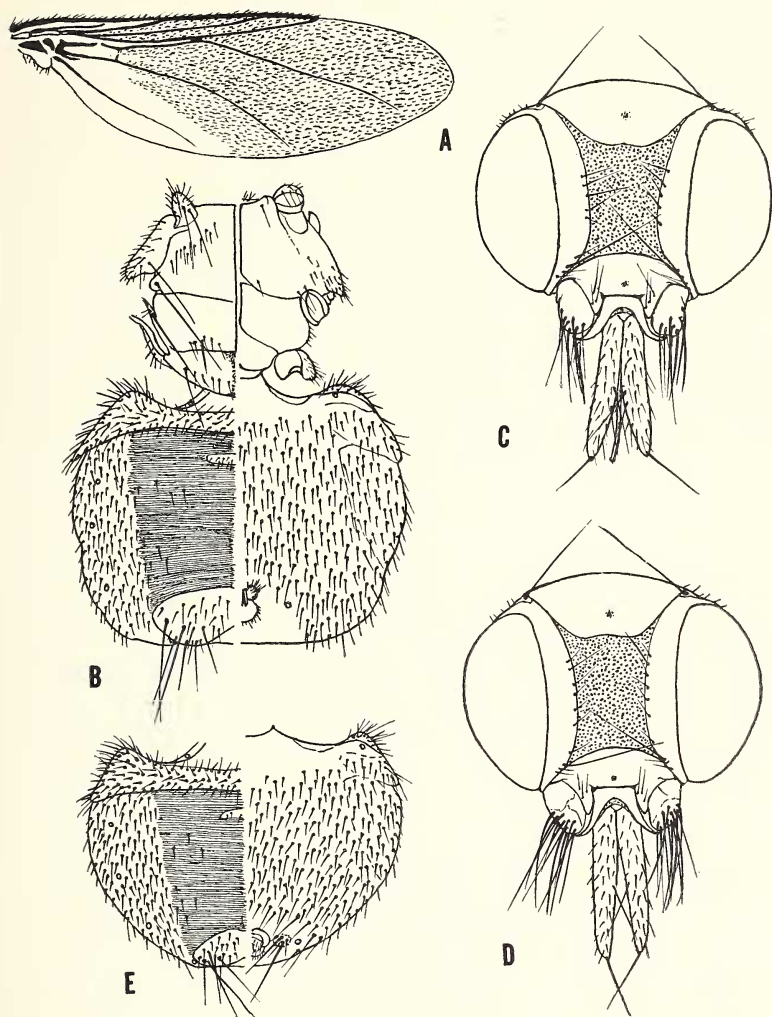


Fig. 56. *Lynchia latifacies* J. Bequaert, **A-C**, ♂ holotype, Tabatinguera, Brazil: **A**, wing; **B**, thorax and abdomen dorsally and ventrally; **C**, head. **D-E**, ♀ allotype, Paso Yobai, Paraguay, on *Piaya cayana*: **D**, head; **E**, abdomen dorsally and ventrally.

curved bristles. Palpi long, distinctly longer than mediovertex and than half the height of head. Thorax (Fig. 56*B*) dorsally: anterior margin nearly straight medially; humeral callosities decidedly longer than wide, fairly prominent, bluntly rounded at apex, with 2 long bristles and several short, stiff setae; mesonotum with 2 small, transverse patches of a few soft setulae on each side, one behind humeral callosity, the other before scutellum, the prescutellar patch with 1 rather short, stiff bristle; 1 very long notopleural and 1 similar postalar bristle on each side; dorsal anepisternum with scattered short setae and 1 long bristle behind mid-length. Scutellum semi-elliptical; hind margin moderately and evenly convex seen from above; blunt edge fringed with soft setulae; a few short preapical setae at extreme sides; 1 short, rather weak discoscutellar bristle in each corner; surface with a shallow longitudinal groove, triangularly widened anteriorly, linear posteriorly. Metathoracic pleurotergite with a few short, stiff setae in a slanting row. No metasternal spurs near hind coxae. Legs rather long and slender; femora and tibiae with the usual long bristles, but only moderately setulose; 4th tarsal segment of fore legs normal. Wing (Fig. 56*A*) relatively long and narrow; microtrichia covering most of membrane, but bare over the following areas: entire postaxillary cell; most of basal half and apical hind third of combined anal, 3rd posterior and axillary cells; entire 2nd basal cell; and extreme base of 2nd posterior cell; costa moderately thickened beyond tip of 1st longitudinal vein; 2nd basal cell much less than half as long as 1st; anterior basal cross-vein nearly vertical and almost complete; costa and subcosta densely setulose; anterior cross-vein very short and thick; subcosta incomplete, but its tip only narrowly separated from costa, stopping basad of anterior basal cross-vein; 1st longitudinal vein ending in costa much basad of anterior cross-vein. Abdomen (Fig. 56*B*) dorsally with the usual transverse basal sclerite (fused laterotergites), triangularly produced behind at each side corner; a large, transverse, reniform preapical sclerite, with a few scattered short setae and posteriorly on each side with 5 to 7 long, stiff bristles; median striolate dorsal area almost bare, with one small differentiated, smooth, median sclerite a short distance behind the basal laterotergites; soft areas of sides of dorsum and venter fairly uniformly covered with many moderately long and short setae on very small tubercles. Setigerous lobes at sides of genital atrium very small.

Length from tips of apical arms of frons to hind margin of scutellum, 3.5 mm.; of wing, 5.8 mm.; width of wing, 1.7 mm.; (total length of dry, pinned specimen, about 4.3 mm.).

Female (Figs. 56D–E) similar to the ♂, particularly in the relative width of the interocular face and of the inner orbits, and in the presence of one small, smooth median sclerite on the dorsum of the abdomen behind the basal laterotergites. Subcosta incomplete in both wings. Venter between the 7th abdominal spiracle and the ano-genital openings with a soft setigerous knob, lacking in the ♂.

Length from tips of apical arms of frons to hind margin of scutellum, 4 mm.; of wing, 7 mm.; width of wing, 2.3 mm.; (total length of dry, pinned specimen, about 5.3 mm.).

BRAZIL: Tabatinguera, State São Paulo, from unknown host, ♂ holotype (Mus. Comp. Zool., Cambridge, Mass., No. 29185).

PARAGUAY: Paso Yobai, Caaguazú, ♀ allotype, on *Piaya cayana macroura* (Foerster. — Fundación Miguel Lillo, Tucumán).

As the description and figures were made from dry flies, they will have to be revised later with fresh or alcoholic specimens. The species is intermediate in size between the large and the small *Lynchia*. Among the small species, it resembles *L. plaumanni* superficially, but differs particularly in the lack of rudimentary ocelli and the extent of the area covered with microtrichia in the wing. It appears to be closely related to *L. americana*, from which it may be separated by the somewhat smaller size and the few characters mentioned in the key.

The only known host belongs to the order Cuculiformes; but it would be premature to draw conclusions from the single host record.

Lynchia angustifrons (van der Wulp)

Figs. 57A–C and 58

Olfersia angustifrons van der Wulp, 1903, Biol. Centr.-Amer., Diptera, 2, p. 430;

Pl. 13, figs. 3–3a (♂ ♀; no host. Mexico: ♂ Teapa, State of Tabasco. Costa Rica: ♀ Río Sucio. Cotypes at Brit.Mus.). Austen, 1903, Ann. Mag. Nat. Hist., (7), 12, p. 265 (types. Mexico: Oajaca). Aldrich, 1905, Smithson. Misc. Coll., 46, No. 1444, p. 655. Speiser, 1907, Ent. News, 18, p. 104; 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304. Swenk, 1916, Jl. New York Ent. Soc., 24, pp. 130 and 132 (Mexico: Motzorongo, State of Vera Cruz, on *Trogon* sp.).

Ornithoponus angustifrons Johnson, 1925, Occ. Papers Boston Soc. Nat. Hist., 7, p. 294 (New Hampshire: Hampton).

Lynchia angustifrons Ferris, 1930, Canad. Entom., 72, p. 68, figs. 5E and G (Panama: Camp Pital, Chiriqui Mts., on *Ramphastos swainsonii*). Dunn, 1934, Psyche, 41, p. 175 (misspelled "*angustifrons*"). J. Bequaert, 1938, Carnegie Inst. Washington, Publ. No. 499, p. 227; 1940, Rev. Acad. Colombiana Cienc. Ex. Fis. Nat., 3, No. 12, p. 416; 1943, Jl. of Parasitology, 29, pp. 132 and 134. MacArthur, 1948, Bull. Publ. Mus. Milwaukee, 8, pt. 4, pp. 412 and 419, fig. 247 (Wisconsin: Madison, Dane Co., on *Accipiter striatus velox*. Illinois: Herrin, on *Strix v. varia*. Minnesota: Little Falls, Morrison Co., on *Buteo p. platypterus*).

Olfersia fusca Ad. Lutz, Neiva and Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 182 (Brazil: Est. São Paulo, on *Pitylus fuliginosus*, *Veniliornis affinis ruficeps* ["*Dendrobates rugiceps*"], *Glaucidium b. brasilianum* and *Baryphthengus r. ruficapillus* ["*Momotus rufescens*"]); Est. Rio de Janeiro, on *Glaucidium b. brasilianum*). Not of Macquart, 1845.

Distribution and Specimens Examined. DOMINION OF CANADA. ONTARIO: Vineland, Lincoln Co., 43° 12' N., on *Accipiter striatus velox* (W.G. Garlick).

UNITED STATES. ILLINOIS (recorded by MacArthur, 1948): Herin, Williamson Co., on *Strix v. varia*, Oct. (N.A. Meinkoth). — MARYLAND: Bowie, Patuxent Research Refuge, Prince Georges Co., on *Accipiter cooperii* and *Buteo l. lineatus* (R.T. Mitchell). — MASSACHUSETTS: Easthampton, Hampshire Co., on *Accipiter striatus velox* (C.K. Merriam). — MICHIGAN: Whitefish Pt., Chippewa Co. (Edna Brodkorb). — MINNESOTA (recorded by MacArthur, 1948): Little Falls, Morrison Co., on *Buteo p. platypterus* (G. Swanson). — MISSOURI: Columbia, Boone Co., on hawk (L. Jeffrey). — NEW HAMPSHIRE (recorded by Johnson, 1925): Hampton, Rockingham Co., May 13 (S. Shaw). — PENNSYLVANIA: Forest Hill near Pittsburgh, on *Hylocichla mustelina* (R.H. Fricke). — TEXAS: 4 miles W. of Wells, Cherokee Co., on *Buteo p. platypterus*. — VIRGINIA: Falls Church, Fairfax Co. (A. Wetmore). — WISCONSIN (recorded by MacArthur, 1948): Madison, Dane Co., on *Accipiter striatus velox*, May 8 (R. Rausch).

MEXICO (recorded by van der Wulp, 1903; Swenk, 1916): without precise locality, on *Accipiter striatus velox* (C.H. Merriam); Teapa, State Tabasco (H.H. Smith. — Cotype ♂ of *angustifrons*); State Oajaca; Laguna Ocotal, State Chiapas, ♀ and ♂ on *Hypomorphnus urubitinga ridgwayi* (R.A. Paynter, Jr.); Misantra, State Vera Cruz, on *Cathartes a. aura* (W. Engelmann); Xilitla, State San Luis Potosi, on *Momotus momota coeruliceps* (J. Newman); Motzorongo, State Vera Cruz, on *Trogon* sp. (L. Bruner); Cacahoatan, State Chiapas, on *Busarellus n. nigricollis* (Esc.N.C.Biol.); Las Nubes, 1200 m., State Chiapas, on *Ciccaba virgata centralis* (Esc.N.C.Biol.); Finca Esperanza, State Chiapas (P. Brodkorb); El Ocote, Ocozocoautla, State Chiapas, on *Micrastur ruficollis guerilla* (M. Alvarez del Toro).

BRITISH HONDURAS: El Cayo, on *Odontriorchis palliatus*, *Glaucidium brasilianum ridgwayi*, and *Ictinia plumbea* (J. Van Tyne).

GUATEMALA: Uuxactun, Peten, on *Accipiter b. bicolor* and *Ramphastos s. sulfuratus* (J. Van Tyne); Olas de Moca, Dept. Solola, on owl (G.P. Engelhardt).

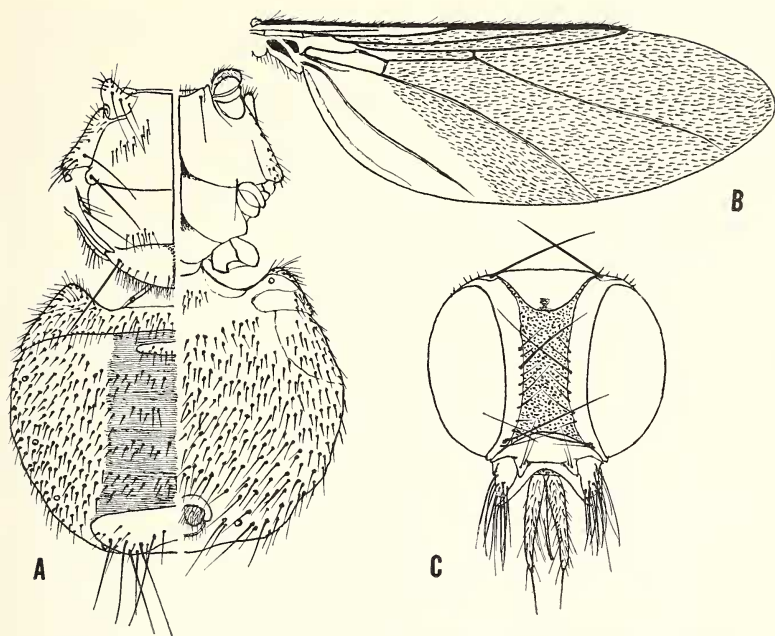


Fig. 57. *Lynchia angustifrons* (van der Wulp), ♀, Hampton, N.H.: **A**, thorax and abdomen dorsally and ventrally; **B**, wing; **C**, head.

COSTA RICA (recorded by van der Wulp, 1903): Río Sueño (Rogers.—Cotype ♀ of *angustifrons*); Higuito, San Mateo (P. Schild).

PANAMA (recorded by Ferris, 1930; Dunn, 1934): Limestone Caves, Río Chillibrillo, C.Z. (T. Hallinan); Culebra, Arrijan Trail, C.Z. (T. Hallinan); Barro Colorado, C.Z., on *Leucopternis albicollis costaricensis* and *Ramphastos sulfuratus brevicarinatus* (J. Van Tyne); Alhajuelo, C.Z., on *Falco s. sparverius* (A. Busek); Camp Pital, Chiriqui Prov., R.P., on *Ramphastos swainsonii* (L. H. Dunn).

COLOMBIA: Norosi, Depto. Bolivar, on *Micrastur semitorquatus naso* (M.A. Carriker, Jr.).

VENEZUELA: Mérida (Gehringer); Cariaquito, Dept. of Bermudez, State of Sucre (S. Brown).

BRITISH GUIANA: Issororo, Northwestern District, on *Accipiter b. bicolor* (G.M. Vevens); Kartabo (W. Beebe); Paraweeka Creek, on hawk (C.E. Bodkin).

BRAZIL (recorded by Lutz, Neiva and da Costa Lima, 1915, as *O. fusca*): Joinville near Humboldt, State Santa Catharina, on

"*Bubo crassirostris*"⁴⁶ and *Elanus l. leucurus* (W. Ehrardt); Jundi-ahy, State São Paulo; Nova Teutonia near Itá, State Santa Catharina, on *Micrastur r. ruficollis* and *Ictinia plumbea* (F. Plaumann); Angra dos Reis, State Rio de Janeiro (L. Travassos); Iguaçu, State Paraná, on *Ramphastos dicolorus* (Inst.Osw.Cruz); Varjão do Guaratuba, State São Paulo, on *Hypomorphnus u. urubitinga* (E. Dente); Fazenda Pinheiro, Lucelia, State São Paulo, on *Pteroglossus a. aracari* (Frisch); Juquía, State São Paulo, on *Buteo m. magnirostris* and *Cyanocorax caeruleus* (F. Dane); Ypiranga, State São Paulo, on *Pyroderus s. scutatus* (J. Lima); Rio Itaunas, Conceição da Barra, State Espírito Santo, on *Glaucidium b. brasilianum* (E. Dente); Fazenda Bom Retiro, Alem Paraiba, State Minas Gerais, on *Hypomorphnus u. urubitinga* (C. Lake); Rio Doce, State Minas Gerais, on *Micrastur r. ruficollis*; Floresta da Capela de S. Braz, Sa. Teresa, State Espírito Santo, on *Micrastur r. ruficollis* (C. Lako); Ilha do Cordoso, State São Paulo, on 2 *Milvago c. chimachima* and *Cyanocorax caeruleus*; Ubatuba, State São Paulo.

PARAGUAY: Paso Yobai, Caaguazú, on *Amazona aestiva xanthopteryx* (Foerster).

L. angustifrons is restricted to the New World, where it ranges from Minnesota, southern Ontario and New Hampshire to southern Brazil. The northmost record is from Minnesota (about 46° N.) and the southmost from the State of Santa Catharina (about 27° S.). It is essentially a Neotropical insect which strays fairly often to the Nearctic Region with some of its migratory hosts, though it is only a summer resident there. The few birds on which it has been taken in the United States and Canada, 6 species in all, occur also farther south, at least during the winter. *L. angustifrons* will eventually be recognized as a common bird-fly throughout tropical Central and South America.

Known Nearctic Hosts of *L. angustifrons* (verified individual records in parentheses). Falconiformes (7 and 1 unidentified hawk): *Accipiter cooperii* (1); *A. striatus velox* (3); *Buteo l. lineatus* (1); *B. p. platypterus* (2). Strigiformes (1): *Strix v. varia* (1). Passeriformes (1): *Hylocichla mustelina* (1).

Known Neotropical Hosts of *L. angustifrons*. Falconiformes (22 and 1 unidentified hawk): *Accipiter b. bicolor* (2); *A. striatus velox* (1); *Busarellus n. nigricollis* (1); *Buteo m. magnirostris* (1); *Cathartes a. aura* (1); *Elanus l. leucurus* (1); *Falco s. sparverius*

⁴⁶ No such name could be traced among the owls. Possibly an error for *Buteo magnirostris*.

(1); *Hypomorphnus u. urubitinga* (2); *H. urubitinga ridgwayi* (1); *Ictinia plumbea* (2); *Leucopternis albicollis costaricensis* (1); *Micrastur r. ruficollis* (4); *M. semitorquatus naso* (1); *Milvago c. chimachima* (2); *Odontorhynchus palliatus* (1). Psittaciformes (1): *Amazona aestiva xanthopteryx* (1). Strigiformes (3 and 1 unidentified owl): *Ciccaba virgata centralis* (1); *Glaucidium b. brasilianum* (1); *G. brasilianum ridgwayi* (1). Trogoniformes (1): *Trogon* sp. (1). Coraciiformes (1): *Baryphthengus r. ruficapillus*; *Momotus momota coeruliceps* (1). Piciformes (5): *Pteroglossus a. aracari* (1); *Ramphastos dicolorus* (1); *R. s. sulfuratus* (1); *R. sulfuratus brevicarinatus* (1); *R. swainsonii* (1); *Veniliornis affinis ruficeps*. Passeriformes (3): *Cyanocorax caeruleus* (2); *Pitylus fuliginosus*; *Pyroderus s. scutatus* (1).

Bionomics. Little is known of the life-history of *L. angustifrons*, even the information on the host relations being unsatisfactory. The Falconiformes, with 8 of the 10 Nearetic and 23 of the 37 Neotropical verified records, are unquestionably the most important and, possibly with owls, the only regular breeding hosts. At present, however, the toucans (Rhamphastidae in Piciformes, with 5 records) cannot be completely ruled out as such, considering how difficult it is to obtain flies from these birds. The few records from parrots, trogons, motmots and passerines are almost certainly based on stray occurrences.

Part I gives information on infestation with mites (p. 157) and on host relations (p. 320). A triple infestation of one *Hypomorphnus urubitinga* by *L. angustifrons* and 2 other species of hippoboscids is discussed under *L. wolcottii*. The puparium is unknown.

Affinities. In the account of *L. wolcottii* I consider at some length the remarkable similarity in structure of that species and *L. angustifrons*, both of which occur in the same general area and on similar birds of prey. Apart from size, they differ very little. On the venter, between the 7th abdominal spiracle and the ano-genital openings, the ♀ of *angustifrons* lacks the raised, soft, bristly knob of *wolcottii*, the corresponding area, bearing only 1 to 3 long setae, not being appreciably raised. The femora and tibiae of both species are amply provided with conspicuous, stiff bristles; but they bear relatively few, scattered, shorter soft setae.

The available material is not adequate for a study of intra-specific variation. The venation appears to vary less than in some congeners. The subcosta is almost always incomplete, such being the case in both wings for 19 (14 ♀ and 5 ♂) of 20 flies from a variety of hosts over a wide territory. In only one ♀ from Laguna Ocotal,

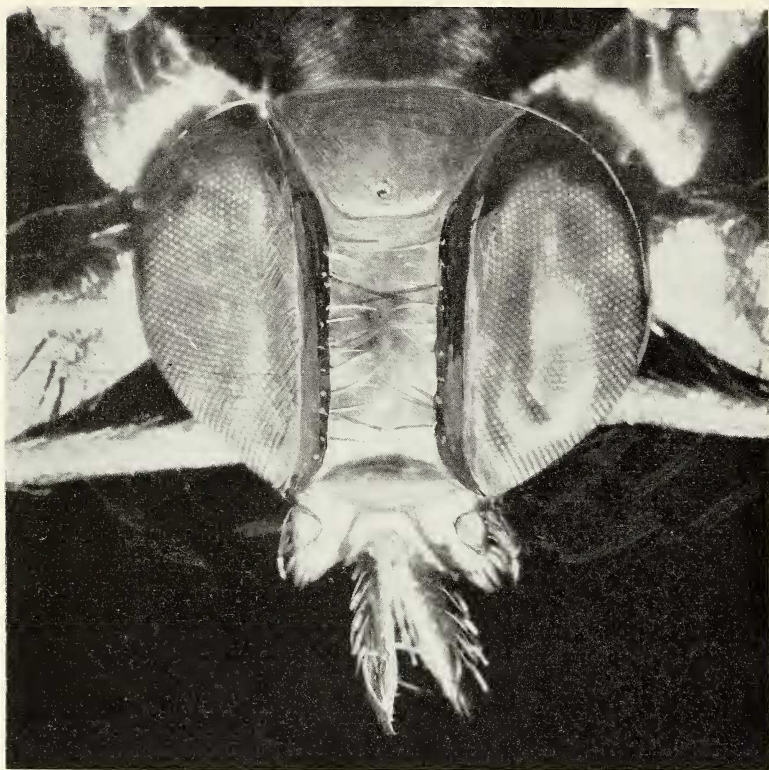


Fig. 58. *Lynchia angustifrons* (van der Wulp), head, ♀, Madison, Wisc., on *Accipiter striatus velox*. Photograph by Mr. K. MacArthur, (1948, fig. 247).

Mexico, on *Hypomorphnus urubitinga ridgwayi*, is the vein incomplete in one wing and complete in the other; another ♀ taken on the same bird has it incomplete in both wings. As usual when the subcosta is incomplete, the vein stops in the membrane at various points, nearly opposite the anterior cross-vein, more basad (Fig. 57B), or farther apicad. In both this species and *L. wolcotti*, the postaxillary cell is relatively wider than in most small species of the genus and provided with a distinct longitudinal crease simulating a supernumerary vein.

As a rule the postvertex has a small median pit, not far from the anterior margin, with which the pit is usually connected by a slight roughened depression. Sometimes the bottom of the pit shows a very rudimentary ocellus.

In both sexes, the dorsum of the abdomen has one small, smooth

median sclerite in the striated area, a short distance behind the fused basal laterotergites; this sclerite is somewhat larger and particularly wider (transversely) in the ♂ than in the ♀. Otherwise there is very little difference between the sexes, the relative width of the interocular face being about the same in both.

The setigerous lobe or flap at each side of the genital atrium of the ♂ is similar in size and shape to that of *L. albipennis*.

Original description of *O. angustifrons*: "♂ ♀. Dark brown or blackish, with the legs obscure reddish and the wings brownish-hyaline; 1st vein ending before small cross-vein; 3rd vein reaching costa at $\frac{3}{4}$ its length; auxiliary vein [subcosta] incomplete. Length 4 mm. More obscurely colored than the preceding [*O. coriacea*], and with the auxiliary vein [subcosta] (which accompanies the 1st vein for about $\frac{1}{2}$ its length) not reaching to costa; the front [interocular face] is scarcely as broad as the eyes and has a narrow glossy space at the sides [inner orbits] and a glossy plate behind [postvertex] which is notched in the middle; the proboscis is longer. The coniform processes on the shoulders [humeral callosities] and the transverse [mesonotal] suture on the thorax are distinct, but the other impressions of the latter are less conspicuous. The legs are rufous, the hind femora elongated. The 1st vein ends distinctly before the small [anterior] cross-vein, which stands nearly at the middle of the wing's length; the 2nd basal cell is much shorter than the superior [1st] one and retracted to near the base of the wing." The two cotypes, seen at the Brit.Mus. in 1951, have the subcosta incomplete in both wings, as noted in the original description. According to Dr. G.B. Fairchild (*in litt.*, Nov. 1953), the wing is 5.4 mm. long in the ♂ and 5.6 mm. in the ♀.

Lynchia wolcotti (Swenk)

Figs. 59A-D and 60A

Olfersia wolcotti Swenk, 1916, Jl. New York Ent. Soc., **24**, p. 132 (no sex. Michigan: Ann Arbor, on *Buteo p. platypterus*. Type ♀ at Dept. Entom., Univ. Nebraska, Lincoln). Muma, 1952, Bull. Univ. Nebraska State Mus., **3**, pt. 3, p. 14 (type).

Lynchia wolcotti Peters, 1936, Bird-Banding, **7**, p. 13 (Michigan: on *Accipiter striatus velox*). J. Bequaert, 1945, Psyche, **52**, pp. 89 and 101. MacArthur, 1948, Bull. Publ. Mus. Milwaukee, **8**, pt. 4, pp. 412 and 419 (Michigan: Swenk's and Peters' records).

Distribution and Specimens Examined. UNITED STATES.

MICHIGAN (recorded by Swenk, 1916; Peters, 1936; MacArthur, 1948): ♀ without precise locality; Ann Arbor, Washtenaw Co., on *Buteo p. platypterus* (♀ holotype.—R.H. Wolcott); McMillan, Luce Co., 2 ♀ on *Accipiter striatus velox*, May 6 (O.M. Bryens; specimens recorded without precise locality by Peters, 1936, and MacArthur, 1948). — NEBRASKA: Lincoln, Lancaster Co., ♀ on *Buteo p. platypterus* (C.E. Mickel). — NEW HAMPSHIRE: Sandwich, Carroll Co., April 28, ♀ on *Buteo p. platypterus* (R.G. Carpenter).

MEXICO: Unión Juárez, 1300 m., State Chiapas, ♀ (P. Brodkorb); Laguna Ocotal, State Chiapas, 2 ♀ on *Micrastur semitorquatus naso* and 1 ♂ on *Hypomorphnus urubitinga ridgwayi* (R.A. Paynter,

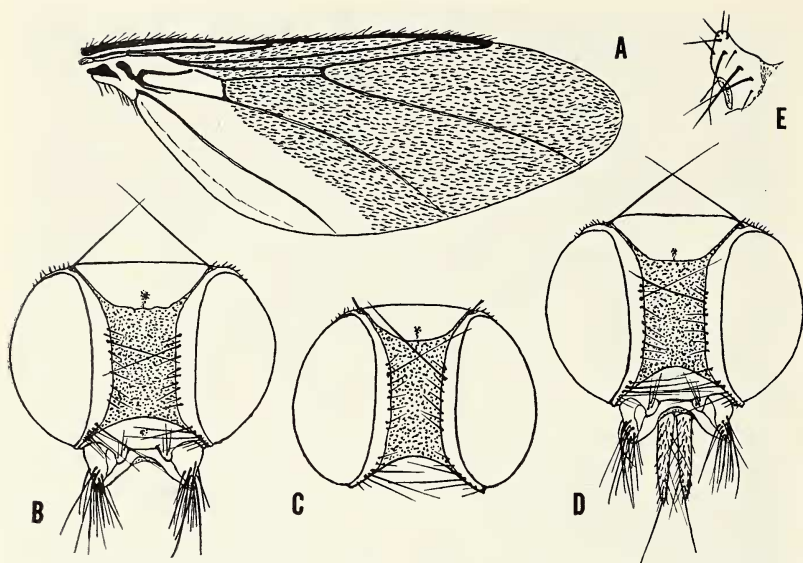


Fig. 59. *Lynchia wolcotti* (Swenk). A, B and E, ♂, Turrialba, Costa Rica, on owl; C, ♀, Nova Teutonia, Brazil, on *Micrastur r. ruficollis*; D, ♀, El Volcán, Panama, on hawk: A, wing; B, C and D, head; E, humeral callosity.

Jr.); Cerro del Sumidero, Tuxtla Gutiérrez, 1300 m., State Chiapas, 2 ♀ on *Otus g. guatemalae* (M. Alvarez del Toro).

COSTA RICA: Turrialba, ♂ on owl, possibly *Lophostrix cristata stricklandi* (K.W. Cooper).

PANAMA: El Volcán, 4100 ft., Chiriqui Prov., R.P., 6 ♀ on hawk (C.S. Worth); Horquete, 5400 ft., Boquete Prov., R.P., ♀ on *Ciccaba virgata centralis*; Almirante, Bocas del Toro Prov., R.P., ♀ on *Leucopternis albicollis costaricensis* (J.B. Smith).

VENEZUELA: Rancho Grande, State Aragua, ♀ on *Urubitornis s. solitaria* (W. Beebe); Arabupu, Mt. Roraima, State Bolivar, ♀ on *Glaucidium brasilianum phalaenoides* (T.D. Carter).

BRAZIL: Nova Teutonia near Itá, State Santa Catharina, 27° 11' S., 2 ♀ on *Micrastur r. ruficollis* (F. Plaumann).

ARGENTINA: Tucumán City, Tucumán, ♀ on *Asio flammeus suinda*, Sept. 15 (O. Budin); Cerro de San Javier, Tucumán, ♀ on *Micrastur gilvicollis*, Oct. 20 (O. Budin).

L. wolcotti is one of the rarer American Hippoboscidae. The 26 known specimens are from 16 localities spread from the Great Lakes to northern Argentina and southeastern Brazil. The northmost locality is in Michigan (46° 20' N.) and the southmost in Brazil

(27° 11' S.). It probably occurs sporadically over most of the New World.

Known Hosts of *L. wolcotti* (verified individual records in parentheses). Falconiformes (10 and 1 unnamed hawk): *Accipiter striatus velox* (1); *Buteo p. platypterus* (3); *Hypomorphnus urubitinga ridgwayi* (1); *Leucopternis albicollis costaricensis* (1); *Micrastur gilvicollis* (1); *M. r. ruficollis* (1); *M. semitorquatus naso* (1); *Urubitornis s. solitaria* (1). Strigiformes (4 and 1 unnamed owl): *Asio flammeus suinda* (1); *Ciccaba virgata centralis* (1); *Glaucidium brasilianum phalaenoides* (1); *Otus g. guatemalae* (1).

Bionomics. The host records show that the breeding hosts of *L. wolcotti* are only birds of prey. But whether it prefers diurnal or nocturnal Raptores is as yet uncertain, though there are more records from the former. The puparium is unknown. Dr. R.A. Paynter observed 2 cases of multiple infestation at Laguna Ocotol, Mexico: one *Hypomorphnus u. ridgwayi* carried 1 ♂ of *L. wolcotti*, 1 ♀ and 1 ♂ of *Lynchia angustifrons* and 1 ♀ of *Ornithoctona erythrocephala*; while one *Micrastur s. naso* harbored 2 ♀ of *Ornithoctona erythrocephala* and 2 ♀ of *L. wolcotti*.

Affinities. At one time (1933b, p. 78) I regarded *L. wolcotti* as based on *L. americana* with abnormally narrow interocular face. I now consider them distinct, though very closely related species. They seem to differ consistently only in the interocular face, which is much narrower in *wolcotti* (proportion of length to width at its narrowest, about 4.5:2.5 in *wolcotti*, 4.5:3 in *americana*). Some other differences may prove unreliable when more specimens are studied and are, moreover, difficult to appreciate. In *wolcotti*, the inner orbits are relatively narrow, usually $\frac{1}{3}$ of the width of the mediovertex; the palpi are somewhat longer than in *americana*, being only slightly shorter than the mediovertex (Fig. 59D); and the humeral callosities appear more acute and more slender (Fig. 59E). Each side of the postvertex usually has one vertical bristle; but there are 2 bristles on each side in a ♀ from McMillan, Mich., the other ♀ taken with it having only one. The subcosta is incomplete in both wings in the few specimens seen.

L. wolcotti resembles *L. angustifrons* very closely, the proportions of the interocular face being about the same in both; but *L. wolcotti* is always much larger (wing 8 mm., combined head and thorax about 4 mm. long in *wolcotti*; wing 5 to 6 mm., combined head and thorax about 3 mm. long in *angustifrons*). The width of the interocular face varies somewhat in *wolcotti*, as shown in Figs.

59B-D; but I saw no specimens actually transitional to *L. americana*. The close relationship of *L. americana*, *L. wolcottii* and *L. angustifrons* is puzzling from an evolutionary point of view, as they occur in the same territory on similar or even identical hosts. All three have been taken on the same host species and subspecies (*Accipiter striatus velox*). Both *wolcottii* and *angustifrons* are recorded from *Hypomorphnus urubitinga*, *Buteo platypterus*, *Glaucidium brasilianum* and *Ciccaba virgata*; while *wolcottii* and *americana* are both known from *Buteo platypterus*, *Glaucidium brasilianum* and *Ciccaba virgata*. Possibly all 3 species are comparatively recent offshoots from a common ancestral stock.

Original description of *O. wolcottii*: "Of the same size and general appearance as *O. americana* Leach, above redescribed, but the front [interocular face] much narrower, not wider than the breadth of an eye, the orbital margins subparallel or but slightly narrowing anteriorly; clypeus [frons] only about one-half as long as the front [interocular face], the apical section somewhat narrower basally but its apical emargination distinctly deeper and less broad, so that the visible width along the dividing sulcation is nearly one-half of the distance between the lateral apices; palpi blackish, twice as long as the clypeus [frons]; general coloration of head and thorax darker, dark reddish brown rather than yellowish brown as in *americana*, the legs strongly suffused with blackish; wings faintly dusky, the costal veins and basal part of the longitudinal veins blackish." I studied the female holotype at the University of Nebraska in 1940 and again in 1953.

Lynchia nigra (Perty)

Figs. 60B-G, 61 and 62

- Hippobosca nigra* Perty, 1833, Delectus Anim. Artic. Brasil., pt. 3, p. 190; Pl. 37, fig. 15 (no sex; no host. Brazil: State of Piauh. Type ♀ in State Zoological Museum of Bavaria, Munich). Neveu-Lemaire, 1938, Traité Entomologie Médicale Vétérinaire, p. 978 (claims it was found on horse in Brazil, being misled by Perty's use of the generic name *Hippobosca*).
- Pseudolfersia nigra* Austen, 1903, Ann. Mag. Nat. Hist., (7), 12, p. 266 (no records).
- Olfersia nigra* Speiser, 1905, Zeitschr. Syst. Hym. Dipt., 5, p. 356 (new description of type); 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304.
- Lynchia nigra* J. Bequaert, 1933, Psyche, 40, pp. 70 and 79; 1933, Proc. California Ac. Sci., (4), 21, p. 134. Spencer, 1938, Proc. Ent. Soc. British Columbia, No. 34, p. 44 (British Columbia: Huntingdon, on *Falco s. sparverius*). Thompson, 1938, Ent. Mo. Mag., 74, p. 46. J. Bequaert, 1940, Mem. Soc. Cubana Hist. Nat., 14, pt. 4, p. 322; 1940, Rev. Acad. Colombiana Cienc. Ex. Fis. Nat., 3, No. 12, p. 416; 1941, Occ. Papers Bernice P. Bishop Mus., Honolulu, 16, No. 11, pp. 280 and 281; 1942, Bol. Entom. Venezolana, 1, p. 82; 1945, Psyche, 52, pp. 89 and 101. Anduze, Pifano and Vogelsang, 1947, Bol. Entom. Venezolana, Num. Extra, p. 6. MacArthur, 1948, Bull. Publ. Mus. Milwaukee, 8, pt. 4, pp. 411 and 420, figs. 248 and 249 (Wisconsin: Milwaukee Co., on *Accipiter striatus velox*).
- Olfersia fuscipennis* Macquart, 1835, Hist. Nat. Ins. Dipt., 2, p. 640 (no sex; no host. Brazil. Type probably lost; not now at Paris Mus.). Speiser,

- 1907, Ent. News, **18**, p. 104. Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, **7**, p. 189 (copy of original description).
- Olfersia mexicana* Macquart, 1843, Mém. Soc. R. Sci. Agric. Arts Lille, (for 1842), p. 435 (no sex; no host. Mexico. Type ♀ at Paris Mus., from Vera Cruz) [1843, Dipt. Exot., **2**, pt. 3, p. 278]. Osten Sacken, 1858, Cat. Dipt. North America, p. 86; 1878, Smithsonian. Misc. Coll., No. **270**, p. 213. van der Wulp, 1903, Biol. Centr.-Amer., Diptera, **2**, p. 430.⁴⁷
- Ornithomyia intertropica* Walker, 1849, List Dipt. Brit. Mus., **4**, p. 1144 (no sex; no host. Galapagos. Type at Brit. Mus.). Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, **7**, p. 189 (copy of description).
- Olfersia intertropica* Austen, 1903, Ann. Mag. Nat. Hist., (7), **12**, p. 264 (type and 3 other specimens collected by Charles Darwin in the Galapagos. Hawaiian Is.: ♂ ♀ on "owl," Honolulu. Mexico: ♀ Orizaba. Brazil: ♀ Bahia). Aldrich, 1905, Smithsonian. Misc. Coll., **41**, No. 1444, p. 655. Speiser, 1907, Ent. News, **18**, p. 104; 1908, Zeitschr. Wiss. Insektenbiol., **4**, p. 304. Austen, 1911, Bull. Ent. Res., **2**, pt. 2, p. 172, footnote (suggests that *Olfersia acarta* Speiser is a synonym). Bau, 1929, Zoolog. Anzeiger, **85**, p. 10 (Queensland: Cooktown).
- Lynchia intertropica* Ferris, 1930, Canad. Entom., **72**, p. 69, figs. 5B, C, H (Arizona: Tucson, on "western red-tailed hawk" [*Buteo jamaicensis calurus*]).
- Olfersia pallidilabris* Rondani, 1878, Ann. Mus. Civ. Stor. Nat. Genova, **12**, p. 161 (no sex; no host. Mexico. Described from 2 cotypes, now probably lost). Aldrich, 1905, Smithsonian. Misc. Coll., **46**, No. 1444, p. 655. Speiser, 1907, Ent. News, **18**, p. 104; 1908, Zeitschr. Wiss. Insektenbiol., **4**, p. 304. Lutz, Neiva and da Costa Lima, 1915, Mem. Inst., Osw. Cruz, **7**, p. 191 (copy of description).
- Lynchia pallidilabris* J. Bequaert, 1945, Psyche, **52**, p. 104.
- Lynchia palidilabris* Knowlton, Harmston and Stains, 1939, Utah Agric. Expt. Sta., Mimeogr. Ser., **200**, pt. 5, p. 19 (Utah: Richfield, on *Buteo jamaicensis calurus*. Specimen seen my be).
- Olfersia obliquinervis* Rondani, 1878, Ann. Mus. Civ. Stor. Nat. Genova, **12**, p. 162 (no sex; no host. Mexico. Described from 2 cotypes, now probably lost). Aldrich, 1905, Smithsonian. Misc. Coll., **46**, No. 1444, p. 655. Speiser, 1907, Ent. News, **18**, p. 104. Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, **7**, p. 191 (copy of description).
- ? *Ornithomyia villadae* Dugès, 1887, La Naturelleza, Mexico, (2), **1**, pt. 1, p. 20; Pl. 3, figs. 3a-h (no sex. Mexico: on *Buteo jamaicensis calurus* and *Buteo swainsoni* ["*Buteo bairdii*"]). Types presumably lost. Name misspelled "*Ornithomyia villadae*" on p. 18).
- ? *Olfersia villadae* van der Wulp, 1903, Biol. Centr.-Amer., Diptera, **2**, p. 430. Aldrich, 1905, Smithsonian. Misc. Coll., **46**, No. 1444, p. 656. Speiser, 1907, Ent. News, **18**, p. 104 (doubts the generic reference).
- ? *Lynchia villadae* J. Bequaert, 1945, Psyche, **52**, p. 103.
- Olfersia acarta* Speiser, 1902, Zeitschr. Syst. Hym. Dipt., **2**, p. 149 (no sex. Hawaiian Ids.: Molokai, holotype, without host; Lanai, without host; Kona, Hawaii, on "short-eared owl" [probably *Asio flammeus sandwichensis*]). Holotype from Molokai at Bremen Mus.; paratypes from Kona at Brit. Mus., listed as the largest of the three Hawaiian Hippoboscidae by Grimshaw, 1901, Fauna Hawaiiensis, **3**, pt. 1, p. 77; present location of Lanai paratype unknown; 1902, Fauna Hawaiiensis, **3**, pt. 2, p. 87 (host of Molokai fly here given by error as "*Atagen aquila*," a man-of-war bird). Austen, 1903, Ann. Mag. Nat. Hist., (7), **12**, p.

⁴⁷ *Pseudolfersia mexicana* of Speiser (1902), Aldrich (1905), and Speiser (1907) was not Macquart's species, but *Olfersia bisulcata* Macquart.

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- 264 (paratypes from Kona). Alfken, 1904, Zool. Jahrb., Abt. Syst., 19, p. 572. Speiser, 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 303. Bryan, 1934, Proc. Hawaiian Ent. Soc., 8, pt. 3, pp. 443 and 458.
- Olfersia dukei* Austen, 1911, Bull. Ent. Res., 2, pt. 2, p. 171 (♀. Uganda: Nsadz I., in Lake Victoria, on *Haliaeetus v. vocifer*. Type at Brit.Mus.).
- Lynchia dukei* J. Bequaert, 1933, Psyche, 40, pp. 70 and 80; 1945, *Op. cit.*, 52, pp. 89 and 102.
- Ornithomyia nigricans* Johnson, 1898, Proc. Ac. Nat. Sci. Philadelphia, p. 164 (Abyssinia: Dada on Daroli River; 2 specimens seen by me at Ac.N.S.Phila.). Not of Leach, 1817.
- Olfersia raptatorum* Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 181; Pl. 28, fig. 3 (no sex. Brazil: without more precise locality, on *Caracara plancus brasiliensis* ["*Polyborus tharus*"], *Milvago c. chimachima*, *Leucopternis polionota* ["*L. palliata*"], and other diurnal birds of prey; also taken in the State of Piahy on *Cathartes aura ruficollis*. Cotypes at the Instituto Osw. Cruz in Rio de Janeiro). Ad.Lutz and Nuñez-Továr, 1928, Estudios Zoología Parasitología Venezolanas, p. 9 (Venezuela: without precise locality, on diurnal birds of prey). Bau, 1930, Konowia, 9, pt. 3, p. 209 (Bolivia: Las Taperas, on *Herpetotheres cachinnans queribundus*; Río Grande, near Sa. Cruz de la Sierra, on *Buteo* ["*Asturina*"] *nitidus pallidus*). Carbonell, 1938, Parasitología en Venezuela y los Trabajos del Dr. M. Nuñez-Továr, p. 251.
- Lynchia raptatorum* J. Bequaert, 1933, Psyche, 40, p. 82. Martorell, 1939, Jl. Agric. Univ. Puerto Rico, 23, p. 221. J. Bequaert, 1945, Psyche, 52, p. 103.
- Ornithoponus americanus* Johnson, 1924, Zoologica, New York, 5, No. 8, p. 91 (Galapagos: Seymour Bay, Indefatigable I., on *Buteo galapagoensis*). Curran, 1932, Nyt Mag. Naturvidenskab., 71, p. 366 (Galapagos: Santa Cruz, Indefatigable I.). Not of Leach, 1817.
- Lynchia fusca* Knowlton, Harmston and Stains, 1939, Utah Agric. Expt. Sta., Mimeogr. Ser., 200, pt. 5, p. 19 (Utah: Park Valley. Specimen seen by me).
- Lynchia* sp. Travassos and Teixeira de Freitas, 1941, Mem. Inst. Osw. Cruz, 35, (for 1940), pt. 3, p. 537 (Brazil: Salobra, State of Matto Grosso, on *Gampsonyx s. swainsonii*. Specimen seen by me).
- The earlier *Hippobosca nigra* Osbeck, 1757, is pre-Linnean, hence without standing in nomenclature. It was later cited by v. Olfers (1816), but without a description, so that it remained a *nomen nudum*. It does not invalidate Perty's *Hippobosca nigra*.
- Several published references to "*nigra* Perty," not included in the foregoing bibliography, were based on misidentifications. Thus Walker's (1849) *O. nigra* was *Olfersia spinifera*. Lutz, Neiva and da Costa Lima's (1915) *O. nigra*, from owls in Brazil, was *L. americana* Leach, while their *Olfersia raptatorum* was the true *L. nigra* Perty. Austen's (1903) *Pseudolfersia nigra* appears to have been *Olfersia spinifera*. Johnson's (1924) supposed *O. intertropicus*, from the Galapagos, was *Lynchia albipennis*.

Distribution and Specimens Examined. DOMINION OF CANADA. ALBERTA: McMurray, 56° 40' N. (J.A. Loring).—BRITISH COLUMBIA (recorded by Spencer, 1938): Osayoos, Bridesville, Summit, Yale-Cariboo Co., 49° 2' N., on *Buteo jamaicensis borealis* (L.M. Laing); Huntingdon, New Westminster Co., 49° N., on *Falco s. sparverius* (G.J. Spencer); Grindrod, Yale-Cariboo Co., 50° 37' N., on *Buteo jamaicensis borealis* (J. Wynne); Merritt, Yale-Cariboo Co.,

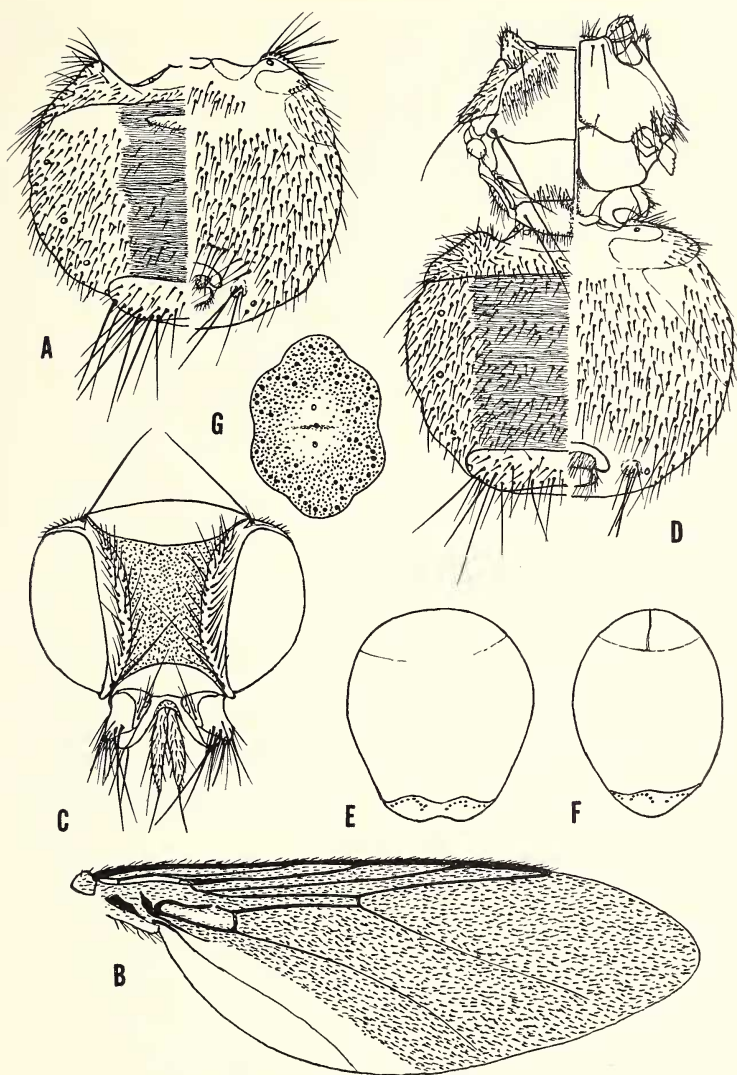


Fig. 60. **A**, *Lynchia wolcotti* (Swenk), abdomen dorsally and ventrally, ♀, Arabupu, Venezuela, on *Glaucidium brasilianum phalaenoides*. **B-G**, *Lynchia nigra* (Perty): **B-D**, ♀, Subirana, Honduras: **B**, wing; **C**, head; **D**, thorax and abdomen dorsally and ventrally; **E-G**, puparium, West Point, N.Y., from fly on *Buteo jamaicensis borealis*, from above (**E**), in side view (**F**) and respiratory lobes (**G**).

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50° 6' N., on *Buteo jamaicensis borealis* (J.A. Munro). — QUEBEC: Kamouraska (au Moulin), Kamouraska Co., 47° 35' N., on *Falco peregrinus anatum* (W. LaBrie).

UNITED STATES. ARIZONA (recorded by Ferris, 1930): Tucson, Pima Co., on *Buteo nitidus plagiatus*, Apr. 5 (A.R. Phillips), and on *Buteo jamaicensis calurus* (the latter recorded by Ferris, 1930, as *L. intertropica*); Huachuca Mts., Cochise Co. (H.S. Swarth); Sells, Pima Co., on *Buteo swainsoni* (C.T. Vorhies); E. of Tucson, Pima Co., on *Cathartes a. aura* (A.R. Phillips); 3 miles N. of Arivaca Junction, Pima Co., on *Bubo virginianus pallescens*, Dec. 4 (R.W. Dickerman and A.B. Phillips). — COLORADO: Denver, on *Buteo jamaicensis calurus*, March 29 (W.H. Bergtold). — IDAHO: Joe's Gap, Preuss Range, 5 miles N.E. of Montpelier, Bear Lake Co., on *Buteo jamaicensis calurus* (Edna Brodkorb). — KANSAS: Lawrence, Douglas Co., on *Falco s. sparverius*, Apr. 11 (Bunker); Franklin Co., on owl (W. Clanton). — MINNESOTA: without precise locality, on *Falco s. sparverius* (N.B. Nelson). — MONTANA: Beaver Head Co. (H.B. Mills); Truman Siding, Ravalli Co., on *Buteo jamaicensis calurus*, May 11 (N. Krams and R.T. Kawk). — NEW MEXICO: without more precise locality and host; 10 miles N. of Beaverhead Ranger Station Railroad, Catron Co., on *Aquila chrysaetos canadensis* (H.C. Pickens and E.M. Long). — NEW YORK: West Point, Orange Co., on *Buteo jamaicensis borealis*, Apr. 30 (W. Robinson). — TEXAS: Fort Davis, Jeff Davis Co., Apr. 12, on *Falco s. sparverius* and (probably) *Cathartes aura septentrionalis* (J. Van Tyne); Elkart, Anderson Co., on hawk, Apr. 29 (W.S. Crusen); El Paso, 3700 ft., El Paso Co. (H.A. Scullen). — UTAH: 5 miles N. of Moab, Grand Co. (Rowe); Park Valley, Box Elder Co., May 22 (R.C. Roskelley); Richfield, Sevier Co., on *Buteo jamaicensis calurus* (Lee Kay). — WASHINGTON (STATE): Twisp, Okanogan Co., on sparrow hawk (Stanford U. Mus.). — WISCONSIN (recorded by MacArthur, 1948): Milwaukee Co., on *Accipiter striatus velox*, Oct. 5 (P.W. Hoffmann). — WYOMING: without precise locality, on *Circus cyaneus hudsonius*.

MEXICO (recorded by Dugès, 1887, types of his doubtful *O. vil-ladae*; Austen, 1903): Xocempieh, 10 miles from Chichen Itzá, Yucatan (D.B. Legters); between Pisté and Yotzonot, Yucatan, on *Herpetotheres cachinnans chapmani*, Nov. 5 (D.B. Legters); Chichen Itzá, Yucatan, on *Geranospiza n. nigra*, *Buteo magnirostris conspectus*, and *Buteo nitidus plagiatus* (J. Van Tyne); Tabi, Quintana Roo, on *Ictinia plumbea*, June 23 (D.B. Legters); El Sumidero, Tuxtla Gutiérrez, State Chiapas, 400 m., on *Herpetotheres cachinnans chapmani*, Jan. 22 (M. Alvarez del Toro); Divisadero, Tuxtla

Gutiérrez, State Chiapas, 525 m., on *Buteo nitidus plagiatus*, Aug. 3 (M. Alvarez del Toro); Loma Larga, Tuxtla Gutiérrez, State Chiapas, 525 m., on *Buteo nitidus plagiatus*, Sept. 17, and *Buteo jamaicensis costaricensis*, Jan. 15 (M. Alvarez del Toro); Los Frailes Bay, Baja California, on *Caracara cheriway audubonii*, Feb. 16 (G. Augustson); San Carlos Bay, State Sonora, on *Buteo jamaicensis calurus*, Feb. 8 (G. Augustson); Pedregal, Munic. Tancitaro, 6000 ft., State Michoacan, on *Buteo jamaicensis calurus* (H. Hoogstraal and R. Traub); Apatzingan, State Michoacan, on young hawk (R. Traub); La Puerta de Hambre, Munic. Apatzingan, 1200 ft., State Michoacan, on *Falco mexicanus* (R. Traub); Sierra de Nayarit, State Jalisco, Apr. 30, on chicken hawk; Xochitepec, State Morelos, on *Buteo* sp. (Esc.N.C.Biol.); Aguililla, State Morelos (Esc. N.C. Biol.); Mexico City (R. Muller); Payal, State Chiapas (H. Wagner); Orizaba, State of Vera Cruz; 14 miles S. of El Arco Mine, Vizcaina Desert, N. of San Ignacio, Baja California, on hawk (? *Buteo jamaicensis calurus*) (E.S. Ross); El Gavilán, Ocozocoautla, State Chiapas, on *Buteogallus a. anthracinus* (M. Alvarez del Toro).

REPUBLIC OF HONDURAS: Zamorano, 20 miles from Tegucigalpa, on *Buteo nitidus micrus* (S.K. Harris); Subirana, Yoro (R. Stadelmann).

PANAMA: Pacora, Panama Prov., R.P., on *Buteogallus a. anthracinus* (L.H. Dunn).

VENEZUELA (recorded by Lutz and Nuñez-Továr, 1928, as *O. raptatorum*): San Felipe, on *Herpetotheres c. cachinnans* (P. Anduze); between Caracas and El Sombrero, State Miranda (E.G. Holt); Cantaura, State Anzoategui, on *Falco c. columbarius* (F.D. Smith); Caicara, State Monagas, on *Daptrius ater* (F.D. Smith).

BRITISH GUIANA: Upper Rupununi River (J. Ogilvie).

BRAZIL (recorded by Perty, 1833; Austen, 1903; Lutz, Neiva and da Costa Lima, 1915, as *O. raptatorum*): Bahia; Maracajú, State Matto Grosso, on *Cathartes a. aura* and "gavião" or "fulvous-bellied kite" (R.M. Gilmore); Rio São Francisco, State Bahia, on hawk, No. 1004 (J.A. Allen, Thayer Exped.); Nova Teutonia near Itá, State Santa Catharina, on owl (F. Plaumann); Salobra, State Matto Grosso, on *Gampsonyx s. swainsonii* (Inst.Osw.Cruz); Bodoquena, State Matto Grosso; Parnaguá, State Piauí, on *Caracara plancus brasiliensis* and *Cathartes aura ruficollis* (cotypes of *O. raptatorum*. —A. Neiva); State Goyaz, on *Piaya cayana pallescens* (A. Neiva); State Matto Grosso, on *Herpetotheres cachinnans queribundus* (Stanislau); Botucatú, State São Paulo on "gavião" (Werner); Rio das Mortes, Chavantina, State Matto Grosso, on *Falco sparverius*

eidos, *Herpetotheres cachinnans queribundus* and *Milvago c. chimachima* (H. Sick); State Piauí, ♀ holotype of *H. nigra* (now labeled only "Brasilien"); Fazenda Recreio, Coxim, State Mato Grosso, on *Accipiter bicolor pileatus* and *Heterospizias m. meridionalis* (J. Lima).

GALAPAGOS (recorded by Walker, 1849, as *O. intertropica*; Austen, 1903; Johnson, 1924; Curran, 1942): without precise locality (type of *O. intertropica* Walker); Seymour Bay, Indefatigable I., on *Buteo galapagoensis* (W. Beebe); Academy Bay, Indefatigable I., on *Buteo galapagoensis* (J.P. Chapin); head of Tagus Cove, Albemarle I. (Crane Pacific Exp.); James I. (E. Cheesman).

BOLIVIA (recorded by Bau, 1930, as *O. raptatorum*): Buena Vista, Prov. Sara, on a diurnal bird of prey (J. Steinbach).

ARGENTINA: Las Palmas, Chaco, on *Buteo magnirostris superciliaris* (A. Wetmore).

L. nigra is essentially a tropical fly in both the Old and the New World. In the United States and Canada its occurrence is sporadic, probably following occasional introduction of adult flies by migrant birds from farther south. The northmost record from 56° 40' N., in Alberta, is clearly accidental, all other Canadian captures being from south of 51° N. The southmost record, from the Argentinian Chaco (north of 28° S.), is well within the subtropical zone. It has not been taken thus far in the Antilles. In the Old World the distribution, although imperfectly known, appears to be strictly tropical. In Africa, where it has been called thus far *L. dukei*, it is known from the Ivory Coast, the Island of S. Thomé, Cameroon, French Congo, Belgian Congo, Ruanda, Uganda, Ethiopia, Kenya and Tanganyika Territory. There is one published record from Queensland (Bau, 1929). It has also been taken in Hawaii (J. Bequaert, 1941b, p. 281), on the endemic Hawaiian race of *Asio flammeus*.

Known Nearctic Hosts of *L. nigra* (verified individual records in parentheses). Falconiformes (20 and 3 unidentified hawks): *Accipiter striatus velox* (1); *Aquila chrysaëtos canadensis* (1); *Buteo jamaicensis borealis* (4); *B. jamaicensis calurus* (5); *Buteo nitidus plagiatus* (1); *B. swainsoni* (1); *Cathartes a. aura* (1); *Circus cyaneus hudsonius* (1); *Falco peregrinus anatum* (1); *F. s. sparverius* (4). Strigiformes (1 and 1 unidentified owl): *Bubo virginianus pallascens* (1).

Known Neotropical Hosts of *L. nigra*. Falconiformes (32 and 8 unidentified hawks): *Accipiter bicolor pileatus* (1); *Buteo galapagoensis* (2); *B. jamaicensis calurus* (2); *B. jamaicensis costaricensis*

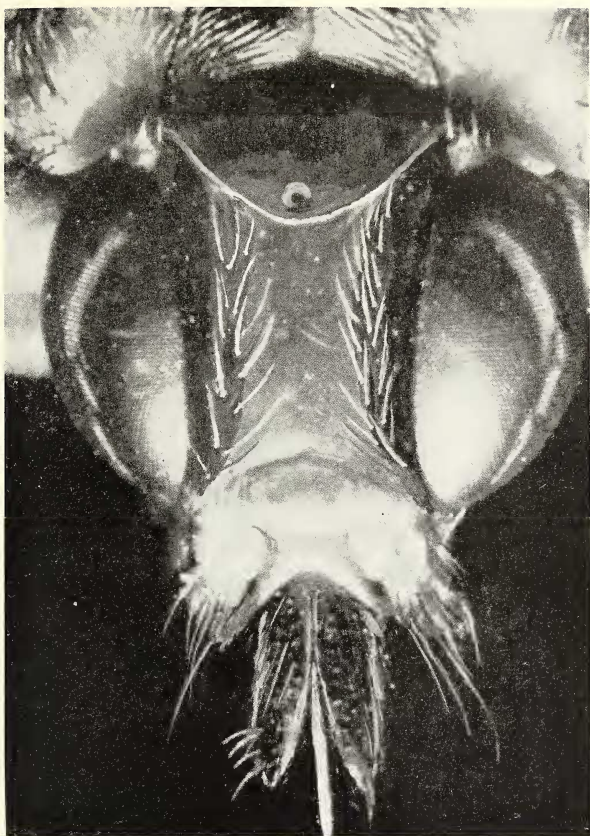


Fig. 61. *Lynchia nigra* (Perty), head, ♂, Milwaukee Co., Wisc., on *Accipiter striatus velox*. Photograph by Mr. K. MacArthur, (1948, fig. 248).

(1); *B. magnirostris conspectus* (1); *B. magnirostris superciliaris* (1); *B. nitidus micrus* (1); *B. nitidus pallidus*; *B. nitidus plagiatus* (3); *B. swainsoni*; *Buteogallus a. anthracinus* (2); *Caracara cheriway audubonii* (1); *C. plancus brasiliensis* (1); *Cathartes a. aura* (1); *C. aura ruficollis* (1); *Daptrius ater* (1); *Falco c. columbarius* (1); *F. mexicanus* (1); *F. sparverius eidos* (1); *Gampsonyx s. swainsonii* (1); *Geranoospiza n. nigra* (1); *Herpetotheres c. cachinnans* (1); *H. cachinnans chapmani* (2); *H. cachinnans queribundus* (2); *Heterospizus m. meridionalis* (1); *Ictinia plumbea* (1); *Leucopternis polionota*; *Milvago c. chimachima* (1). Cuculiformes (1): *Piaya cayana pallescens* (1).

In the Old World the many African records of *L. nigra* (= *dukei*) are all from 10 Falconiformes: *Aquila r. rapax*, *Buteo rufofuscus augur*, *Circæetus cinereus*, *Gymnogenys t. typicus*, *Gypohierax angolensis*, *Haliaeetus v. vocifer* (a particularly favored host), *Hieraëetus ayresii*, *Milvus migrans parasitus*, *Terathopius ecaudatus*, and *Urotriorchis macrourus batesi*. Specimens were taken in Hawaii on an owl, *Asio flammeus sandwichensis*.

Bionomics. The foregoing lists of hosts and verified records show conclusively that *L. nigra* is one of the most characteristic parasites of diurnal birds of prey, which are its only normal breeding hosts in the New World as well as in Africa. It seems to occur only as an accidental stray on the American vultures (Cathartidae); otherwise it shows little selectivity within the order Falconiformes. The very few American captures on a cuckoo (*Piaya*) and on owls were due either to straggling or to contaminations. It is more difficult to account for the several flies taken on four occasions from owls in the Hawaiian Islands. One of these flies dates from 1878 and the collectors noted that it was "frequent on owls." It might be interesting to investigate whether or not *L. nigra* occurs also on the native Hawaiian hawk, *Buteo solitarius*, on which no bird-fly has been taken thus far. Possibly the flies found on the local owls have strayed from this hawk.

Very little is known of the life-history of *L. nigra*. In Part I (p. 157) I mentioned 5 cases of parasitism by mites, to which the following may now be added:

6. Female on *Buteo galapagoensis*, from Academy Bay, Indefatigable I., Galapagos, with one female mite surrounded by a few eggs and fixed to the under side of the anterior cross-vein, about mid-length of the left wing.

7. Female on *Buteo jamaicensis calurus*, from Truman Siding, Montana, with large mite clusters on the under side near the base of both wings, 3 on the right and 4 on the left side.

The following account of the puparium of *L. nigra* (Figs. 60E-G) is based on a specimen deposited as larva by a fly from *Buteo jamaicensis borealis* at West Point, N.Y., April 30. It is not fully colored, being dull reddish mahogany-brown, except for the black cap at the posterior end, but appears otherwise normal. It is very broadly oval, slightly narrowed posteriorly, somewhat more convex dorsally, 4.2 mm. long, 3.2 mm. wide and 2.5 mm. thick. It differs little from that of *L. americana*, but the respiratory pores are fewer in each of the 6 curved groups.

Affinities. *L. nigra* occupies an isolated position in the genus.

In addition to the characters selected for the key, it differs from its congeners as follows. The palpi are moderately long, much less than half, although over one-third of the height of the head (from occipital margin to tips of frontal arms), and broader in profile in proportion to the length than in *L. americana*. The 1st antennal segment is separated from the lunula by a deep, complete suture. The lower (ventral) edge of the antennal pits, on either side of the buccal cavity (filled with the basement membrane), is very prominent, almost tuberculate, densely bristly. The hind corner of the notopleuron (fused with the prescutum), bearing the notopleural bristle, is strongly raised, tuberculate. The humeral callosities are broader than usual, nearly as wide as their distance from the median notal suture. In the wing, the 2nd basal cell is much shorter than half the length of the 1st and broader than in *L. americana*. The body is more hirsute than usual, the setae being more numerous on the occipital surface of the head, the humeral callosities, the anepisternum, the postalar corners of the mesoscutum, the preäpical row and apical fringe of the scutellum, the metathoracic pleurotergite, and the antennae (particularly the 1st segment). Some areas are also covered with grayish-white pollinosity due to matted, dense microscopic hairs (as noted by Ferris, 1930c, pp. 69-70, for *L. intertropica*, a synonym of *L. nigra*), particularly on the upper orbits, antero-lateral corners of prescutum (near the short posthumeral suture), anepisternum (both dorsally and ventrally), metathorax, and a narrow strip close to the scuto-scutellar suture; the abdomen also is often dull grayish pollinose, especially on the large preänal tergite.

The subcosta is normally complete and ending in the costa in *L. nigra*, this being the case in 38 of 39 American, in all 3 Hawaiian, and in all 20 African specimens examined. It is, however, incomplete in both wings in one of a series of 6 flies taken on a hawk in Nayarit, Mexico. The 1st longitudinal ends in the costa opposite the anterior cross-vein or slightly basad (Fig. 60B; and Ferris, 1930c, p. 68, fig. 5B).

L. nigra is the largest species of the genus, the wing being usually 7.5 to 8.5 mm. long, seldom 9 mm. or even slightly more. A dwarf ♀ from Piahy, Brazil, with wings only 7 mm. long, agrees in every other respect with the larger flies.

The African *L. dukei*, thus far generally treated as distinct, is here regarded as not separable from the American *L. nigra*. In the original description, copied below, Austen mentioned its close affinity to *Olfersia intertropica* Walker (a synonym of *L. nigra*), but

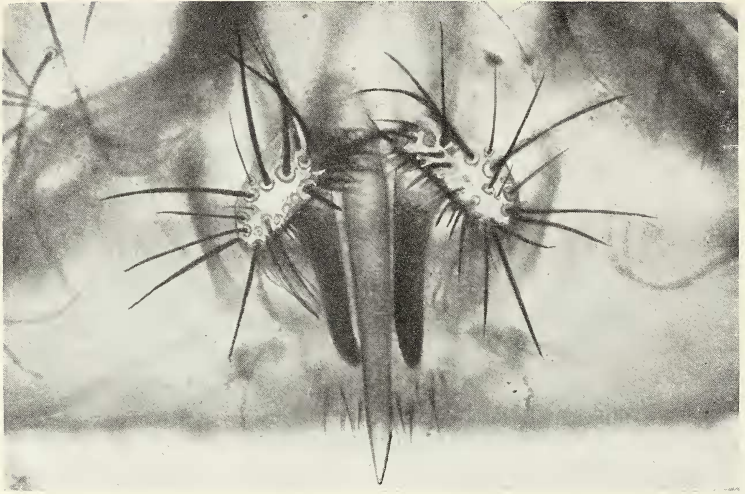


Fig. 62. *Lynchia nigra* (Perty), terminalia of ♂, Milwaukee Co., Wise., on *Accipiter striatus velox*. Photograph by Mr. K. MacArthur (1948, fig. 249).

pointed out some differences. Of these, the more elongate and darker palpi, as well as the sparser and coarser pilosity and sculpture of the inner orbits, soon proved unreliable, when more African material was studied. In my two revisions of the larger *Lynchia* (1933b; 1945b), I retained as distinguishing feature only the shape of the postvertex, contrasting this as follows:

Postvertex long, semi-elliptical, the anterior angles broadly rounded,	
the anterior margin convexly curved and about as long as	
the sides	<i>L. nigra</i>
Postvertex short, more transverse, the anterior angles more abruptly	
rounded off, the anterior margin much longer than the	
sides	<i>L. dukei</i>

A comparison of many African and American specimens has shown that this supposed difference is untenable. The shape of the postvertex varies so much that identical specimens can be found on both sides of the Atlantic. Indeed, in one female from *Buteo jamaicensis calurus*, of Montana, the postvertex is more transverse, shorter and broader than in any African so-called “*dukei*.”

In the male terminalia (Fig. 62), the gonocoxites are larger, more prominently lobate and with heavier bristles in *L. nigra* than in *L. americana*. In both species the abdomen of the ♀ bears ventrally on each side near the apex a setigerous knob not present in the ♂.

Original description of *H. nigra*: "Nigro-fusca; polita, alis subfuliginosis Lg. $2\frac{3}{4}$ lines [German lines=about 5.8 mm.]. Latit. alar. expans. 8 lines [spread of wings=17.5 mm.]. *H. equina* Fabr. paullo minor. Tota nigro-fusca, nitida. Frons glabra, lateribus et postice aeneo-micans. Thorax inaequalis. Abdomen subopacum. Alae subfuliginosae, costa fusca. Subtus cum pedibus paullo dilutior." This description furnishes practically no clue as to the identity of the species and the figure shows only that it was one of the larger American species of *Lynchia*. My study of Perty's type has shown that it is the species described later by Walker as *Ornithomyia intertropica*, by Speiser as *Olfersia acarta*, and by Lutz, Neiva and da Costa Lima as *Olfersia raptatorum*. This type, now at the State Zoological Museum in Munich, is a ♀ with many orbital bristles, placed in more than one row. Speiser (1905), who recognized that it was a *Lynchia* (= *Olfersia* of Speiser, not of Wiedemann), made the following notes (translated from the German): "Length of dry specimen, 5.75 mm.; from apex of frons to hind margin of scutellum, 3.75 mm. Head medium-sized as compared with thorax, with evenly rounded, not sinuate occiput. Postvertex distinctly and rather deeply sinuate anteriorly. Interocular face ['Stirnstrieme'] slightly narrowed anteriorly [toward frons], though fully $\frac{3}{4}$ the width of an eye, even close to frons. Orbits with fine, blond setae. Clypeus [frons] divided by a transverse furrow, the posterior section with a distinct groove, almost as in *Olfersia* ['*Pseudolfersia*' of Speiser], the anterior section split by a flattened emargination into two short points. Antennal appendages short, with black setae. Maxillary palpi almost straight. Thorax of the usual shape and sculpture; humeral callosities and sides of scutellum not paler than remainder of surface; hind margin of scutellum slightly rounded-convex, not truncate. Legs dark brownish-black; under side of femora somewhat paler. Wings brownish; anal [axillary] cell hyaline. Abdomen entirely dried up. The general color, which seems to have been almost black or at least dark pitch-brown when Perty's drawing was made, now looks bleached, pale pitch-brown, the head even somewhat paler."

Original description of *O. fuscipennis* (translated from the French): "Length, $2\frac{1}{2}$ [French] lines [=5.6 mm.]. Pitch-black, somewhat shiny. Palpi rather large, little lengthened, provided with setae. Frons with two small pits; one larger, beyond the suture; the other small, nearer the anterior border. Sides of the buccal cavity protuberant and fringed with long setae; a small spot of white down [pollinosity] at the base of the antennae. Abdomen with a gray down [pollinosity]. Legs brownish-black. Wings blackish; inner side, from the base to near mid-length, pale yellowish." Although Macquart stated that the specimen came from the Paris Museum, it is not to be found there now and is presumably lost. The measurements point to the large South American species of *Lynchia*, *L. nigra*. Some of the characters mentioned in the description fit *L. nigra* so well that I do not hesitate to relegate *O. fuscipennis* to the synonymy of that species. The pitch-black color, the large but moderately long palpi, the protuberant sides of the buccal cavity (immediately below the antennal pits), the pollinose spot at the base of the antenna, the grayish pollinose abdomen, and the blackish wings are particularly to be noted.

Original description of *O. mexicana* (French text translated): "Nigra. Thorace linea dorsali testacea. Alis nigricantibus. Long. $2\frac{3}{4}$ [French] lines [=6 mm.]. Black. Proboscis elongate, yellow. Face brownish, with a cross-line and two pits. Frons [interocular face] with the sides [inner orbits] and occipital spot [postvertex] shiny coppery-green; frontal band [mediovertex] blackish, almost dull. Under side of head testaceous. Thorax with greenish sheen; a testaceous dorsal line; humeri brownish, with a row of small spicules; sternum fulvous. Abdomen brown. Legs black above, greenish-fulvous below. Wings blackish; inner side, from the base to near the middle, pale yellow." The description was based on a specimen at the Paris Museum, evidently one of the larger American species of *Lynchia*. There are now at Paris two flies under "*Olfersia mexicana*." One of these is a female from "Mexico: Vera

Cruz," which I regard as Macquart's type, since it agrees perfectly with the description. It cannot be separated from *L. nigra* (Perty). The second fly is much larger and otherwise also disagrees with the description; it is a female of *Ornithoctona erythrocephala* (Leach). In the Bigot Collection, now the property of Mr. J.E. Collin, there is a third fly labelled "*Olfersia mexicana*," apparently by Macquart himself. This again does not agree with the original description and was identified by me as *Olfersia bisulcata* Macquart. Some time before, Mr. J.E. Collin also reached the conclusion that it was conspecific with the type of *O. bisulcata*, with which he compared it. Moreover, it was examined by Speiser (1904), who placed it correctly in his genus *Pseudolfersia*, now considered a synonym of *Olfersia*. Whichever of the three specimens is taken as the original type, the specific name *mexicana* will be relegated to the synonymy.

Original description of *O. intertropica*: "Picea, ferrugineo varia, verticis margine albedo, pedibus fulvis, alis fuscis. Body pitchy, smooth, shining, thinly clothed with short tawny hairs: crown of the head ferruginous, with whitish borders, mouth and appendages tawny: chest ferruginous on each side and behind and adorned with a ferruginous stripe: abdomen dull, its tip beset with a few stout black bristles: legs dark, tawny, clothed with short black hairs and bristles; claws black; wings brown; wing-ribs and fore border veins pitchy; the other veins dark tawny. Length of the body 3 lines [=6.35 mm.]; of the wings 8 lines [=spread of wings, 17.13 mm.]." Austen (1903) examined the type and concluded that it was a species of *Lynchia* ["*Olfersia*" of Austen, not of Wiedemann]. I have also seen this type at the British Museum and it agrees in every way with what I call *L. nigra*.

Original description of *O. pallidilabris*: "Long. mill. 6-7. Corpus nigrum; labio sordide albicante; fronte nec foveolata nec punctis impressis signata, orbitis angustis et areola verticis pumicatis, ista antice rotundata non in medio incisa. Proboscis nigricans in linguam filiformem non elongata. Palpi nigricantes, proboscide paulo longiores, et ad latera eam tegentes, non erecti. Thorax in dorso, cum scutello nitidissimus. Abdomen opacum, pilosulum, apici plus minusve luride albicans. Alae infuscae, fuscetudine postice versus basim dilutiores: venis nigris: secunda longitudinale, parum sed paulo ante transversam anteriorem costalem attingente: tertia, in costa magis distante a quarta quam a secunda: transversa exterior non obliqua, et paulo ante apicem sita primae longitudinalis. Pedes nigricantes, partim sordide glauci, praesertim antici, ut femora omnia subtus et basi." The types could not be located in 1951 at the Genoa Museum nor in Bellardi's collection now in Turin, and Dr. B. Lanza (*in litt.*, 1953) informs me that they are not in Rondani's collection now in Florence. They are most probably lost. Like *O. obliquinervis* (discussed below), it was evidently one of the larger species of *Lynchia*, either *L. americana* or *L. nigra*. Rondani seems to have separated his *O. obliquinervis* and *O. pallidilabris* mainly by the presence or absence of "foveae" on the frons, as well as by the relative position of the tip of the 1st longitudinal vein (which he calls the "second," as he considers the subcosta to be the "first") and anterior cross-vein (which he calls the "outer cross-vein"). Of *pallidilabris* he says that the "frons" is neither foveolate nor provided with punctiform depressions; and of *obliquinervis* that the "frons" bears an upper impressed dot and a smaller one lower down near the mouth. From the context it is clear that he referred to the depressions on the lunula, which are often but not always present in both *L. americana* and *L. nigra*, so that they are unreliable as a specific character. The tip of the 1st longitudinal is said to be placed in *pallidilabris* "not much but a little ('parum sed paulo') before [basal of] the anterior cross-vein," and in *obliquinervis* "distinctly beyond [apical of] the anterior cross-vein." As Speiser (1902) noted for his *O. acarta*, a synonym of *L. nigra* (see below), the position of the tip of the 1st longitudinal varies in *L. nigra*: it is usually nearly opposite the anterior cross-vein, but it may be also somewhat before or beyond, though never very far. In *L.*

americana, on the other hand, the 1st longitudinal always ends much before (basad of) the anterior cross-vein. For this reason it seems fairly certain that both of Rondani's names were based on specimens of *Lynchia nigra*, a common Mexican fly. Some other features mentioned by Rondani fit *L. nigra* better than *L. americana*, notably the dull whitish bloom (pollinosity) over the hind part of the abdomen. It may be of interest that the late J.M. Aldrich used the trivial name *pallidilabris* for specimens of *L. nigra* at the U.S. National Museum.

Original description of *O. obliquinervis*: "Long. mill. 6-7. Nigro-picea: Frons puncto impresso supero, et minore infero prope os, signata: Verticis areola latiuscula, subtrigona et orbitis angustis nitidissimis. Palpi et proboscis breves, nigricantes. Abdomen nigro-opacum, apice plus minusve sordide albidum. Alae infuscae, angulo interiori axillari fuscissime dilutiores. Pedes nigricantes, femoribus basi, et paulo etiam inferne luride glaucis, etc. Notae istae *O. fuscipennis* Macq. et aliis congeneribus etiam conveniunt, sed in nostra characteres adsunt magni momenti in diagnosis auctorum non indicati, specificam differentiam comprobantes; ut sequitur. Sp. nostrae alae ad radicem tuberculum distinctum, elevatum, nitidum praebent: venulam transversam anteriorem valde obliquam, sub-integram, et interius longe ab apice longitudinalis primae sitam: secundam longitudinalem costali conjunctam distincte ultra transversam anteriorem, et in costa magis proximam tertiae quam primae: tertiam magis proximam quartae quam secundae. Praeterea *fuscipennis* brasiliana, et *obliquinervis* mexicana." As in the case of *O. pallidilabris*, the types of *O. obliquinervis* could not be traced and should be regarded as lost. This species also was evidently either *Lynchia americana* or *L. nigra*, most probably the latter. As shown before, the characters used by Rondani to separate *O. obliquinervis* from *O. pallidilabris* are not reliable and the descriptions of both forms agree better with *L. nigra* than with *L. americana*.

Original description of *O. villadae* (translated from the Spanish): "Shiny blackish-brown; head with a metallic green glitter, changing to coppery with the light; margins of frons [inner orbits], median line of thorax [median notal suture] and scutellum dull reddish; fore legs dark brown, the other four blackish; wings smoky and eyes black. The proboscis, curved downward, is slender at the tip and globose at the base, being inserted on a tubercle shaped as drawn; this organ seems to me to be simple, forming a tube which surrounds a sharp stileto capable of being protruded from a subterminal opening of the tube. The antennae, very setose on their outer surface, consist of two segments, one large, concave anteriorly, the other small, inserted in the concavity of the first. The spoon-shaped palpi cover the base of the proboscis. The first four segments of the tarsi are short and equal; the fifth is longer, hollow beneath, and this space is covered with a membrane, an arrangement which no doubt helps the retraction and hiding of the claws; these are tridentate and have a pad between them; several long bristles arise from the upper as well as the under part of the fifth tarsal segment." It is also stated that there are no ocelli. No measurements are given, but fig. 3a, said to be natural size, is 13 mm. long from anterior margin of frons to tip of folded wings. Fig. 3b shows a typical *Lynchia* head, with the interocular face broader than one eye and narrowed anteriorly, and the palpi much longer than the frons. These features, combined with the fact that it was collected three times and on two species of *Buteo*, make it most probable that *O. villadae* was based on *Lynchia nigra*, the common large *Lynchia* on diurnal birds of prey in Mexico.

Original description of *O. acarta* (translated from the German): "Length, 6.25 mm.; from apex of frons to hind margin of scutellum, 4 mm. Main color dark shiny blackish-brown; humeral callosities and head, particularly mouth-parts, paler, even leather-yellow; basal half of femora of the same color, the legs as a whole somewhat paler. Head slightly over half the greatest width of thorax; occiput evenly rounded, without emargination or inward curve. Vertex [interocular face] a little over $\frac{1}{2}$ of width of head, slightly narrowed

downward over upper $\frac{3}{4}$, then wider again, being at the antennal pits once more as wide as at postvertex, dull medially [mediovertex]; inner orbits and postvertex shiny, the latter with undivided anterior margin. Inner margin of inner orbits with many blond setulae, similar to those of *O. exornata* Speiser and some other species, but not as nicely parted as in *exornata*; I regard this pilosity as the one important difference from *O. pallidilabris* Rondani, the description of which stresses 'orbitis angustis et areola verticis punicatis,' but mentions no pilosity. Frons ['Clypeus oris'] divided into two successive areas, more distinctly in this species than in others; dull leather-yellow (in Rondani's species 'sordide albicans'), anteriorly with a slight angular emargination, but without projecting edges or points; without foveae, unless one should regard as such the slight lateral depressions of the transverse furrow. Antennal appendages fairly long and wide, intensely shiny black, with black bristles. Maxillary palpi, forming the sheath for the proboscis, pitch-brown, projecting slightly beyond frons ['Clypeus'], relatively wide and blunt. Thorax somewhat wider than long, dark shiny blackish-brown, with a very fine yellow longitudinal line [median notal suture], dull leather-yellow humeral callosities, and a small spot of the same color on each lateral angle of scutellum. Postero-lateral angles of prescutum, at dorsopleural and transverse sutures, covered with light spots of dull-gray bloom, present also on pleura before the wings except for a raised streak extending anteriorly and downward from base of wing. Very fine longitudinal suture of thorax continuing over scutellum and much widened there, but narrowing again toward hind margin of scutellum. Transverse [mesonotal] suture not interrupted medially, but instead very fine and linear over $\frac{1}{2}$ to $\frac{3}{4}$ mm. where it crosses the longitudinal furrow, while it is deeply grooved laterally. Scutellum broadly semi-circular, with a transverse furrow before hind margin and with a longitudinal depression, which is at first broad, then narrowed posteriorly into a ridge; the very characteristic yellow spots on the lateral angles were mentioned before; close to these a strong bristle placed on each side more toward the middle in the dark brown area; hind margin densely provided with fine, blond setulae. Similar setulae also on disk of thorax, such setulae not being mentioned for *O. pallidilabris* Rondani. Pleura and humeral callosities with black, short setae, as usual. Fine suture between humeral callosities and prescutum with longer, fine setulae, similar to those of *O. exornata* Speiser, but shorter. Finally two small rounded spots before scutellum covered with very short, golden-yellow setulae. Legs without striking peculiarities. Fore femora rather thick; hind legs somewhat longer than usual. Nothing is to be said about sculpture, setulae or special color pattern; but the wings show interesting features. They are light hazel-brown, not clouded nor milky. Costa interesting, being swollen beyond tip of 1st longitudinal vein ['Subcostalis'] to almost twice basal thickness, as described by Rondani for *O. papuana* and by me for a recent new species, *O. parallelofrons*; 1st longitudinal vein ['Subcosta'] ending basad of anterior cross-vein ['kleine Querader']; 2nd longitudinal vein ['Radialis'] much closer to tip of 1st longitudinal ['Subcosta'] than to that of 3rd longitudinal ['Cubitalis'], exactly as Rondani described for his *O. pallidilabris*, although he did not mention the swollen costa; last section of costa therefore twice as long as penultimate; 4th longitudinal vein ['Discoidalis'] not raised into a knob at its starting point; 2nd basal cell ['hintere Basalzelle'] at its widest not as wide as distance from elbow of 4th longitudinal ['Discoidalis'] to anterior margin, somewhat less than half as long as 1st basal cell ['vordere Basalzelle'] and closed by a distinct cross-vein. Abdomen dull dirty-brown, without peculiarities, somewhat paler and almost yellowish-brown apically." The foregoing description was that of the holotype from Molokai. The following notes were based on additional paratypes: "Head sometimes somewhat more brightly colored; in particular, inner orbits may be almost as pale yellow as frons ['Clypeus oris']. In one specimen, anterior margin of postvertex slightly depressed medially. Position of tip of 1st longitudinal vein variable in this species also:

in several specimens placed directly above anterior cross-vein ['kleine Querader'] and in one even a trifle beyond it in one wing. Finally it should be noted that in most of these paratypes the tip of the abdomen has a whitish bloom, which recalls the 'abdomen . . . apici plus minusve luride albicans' of *O. pallidilabris* Rondani.' The paratypes I have seen from Kona are *L. nigra*; but I have not seen the holotype from Molokai. There can be little doubt, however, that it belonged to the same species, the numerous setulae of the inner orbits being particularly characteristic.

Original description of *O. dukei*: "♀. Length 7 mm.; width of head 2 mm.; width of front [interocular face] at vertex 1.4 mm.; length of wing 9.4 mm. [According to Dr. G.B. Fairchild, Nov. 1953, length of wing 9.1 mm.]. General coloration black or clove-brown; sides of front (frontal margins or parafrontalia [inner orbits]), plate on vertex [postvertex], and dorsum of thorax (except humeral calli) shining black or blackish clove-brown; abdomen, dorsal surfaces of middle and hind legs, and dorsal surface of front femora clove-brown; anterior $\frac{2}{3}$ of inner borders of sides of front [inner orbits] clothed with fairly long yellowish hair, with as usual a single longer black hair in front and behind [orbital bristles]; wings sepia-colored. Head: shining plate on vertex [postvertex] transversely elongate, anterior angles rounded off, length [=width] of hind margin [occipital margin] at least $2\frac{1}{2}$ times as great as depth [=length] of plate from front to rear; frontal stripe [mediovertex] (in dried specimen) clove-brown; face raw-umber-colored in centre, dark brown on each side below; jowls and under surface of head on each side mummy-brown, central area of under surface of head ochraceous buff; under surface of head clothed with bright, ochre-yellow hair; palpi relatively rather narrow (from above downwards) and elongate, their outer surfaces dark brown or clove-brown, and clothed with brownish hair; visible portion of antennae shining dark brown, clothed with black hair. Thorax: humeral calli raw-umber-colored, dark brown behind, clothed above with black mixed with ochre-yellow hairs; portion of dorsum immediately behind humeral calli, and in front of transverse suture, clothed with appressed, ochre-yellow hairs; hind margin of scutellum and portion of thorax immediately in front of scutellum also clothed with ochre-yellow hairs; pleurae blackish and clothed with similarly-colored hair; pectus raw-umber-colored. Abdomen clothed for most part with black hair. Wings: principal veins and thicker portions of veins clove-brown or dark brown. Legs: front tibiae and tarsi, and under surface of front femora (in dried specimen at any rate) more or less raw-umber-colored; under surfaces of middle and hind femora and tibiae (in dried specimen) more or less mummy-brown; legs clothed for most part with black or blackish hair; claws black. Although closely allied to and resembling *Olfersia* (*Ornithomyia*) *intertropica* Walk., the species described above is distinguishable by its more elongate and darker palpi, by the hairs and punctures on the inner borders of the sides of the front [orbital bristles] being fewer in number and coarser, and especially by the different shape of the shining plate on the vertex [postvertex], which is more transversely elongate, and the anterior angles of which are more abruptly rounded off." The type was examined at the British Museum in 1933 and again in 1951. I have given before my reasons for now considering *O. dukei* and *L. nigra* conspecific. In the holotype of *O. dukei* the subcosta is complete in both wings.

Original description of *O. raptatorum* (translated from the Portuguese): "Palpi and antennae yellow, bristles partly dark; frons [interocular face] chocolate color, but anterior and posterior triangles [postvertex and frons] and the lateral margins [inner orbits] ochraceous-gray, with a greenish metallic gloss; small grooves at tips of both triangles; ventral side of head ochraceous. Mesonotum chocolate color, with a greenish gloss and golden hairs; humeral callosities ochraceous-gray, with a whitish spiracular spot at outer base. Median notal suture reddish, continued over hind half of scutellum; the latter rounded, with a depressed submarginal line, and both with bright white termi-

nal ciliae. Transverse mesonotal sutures deep and sinuate, united at median suture. Upper side of abdomen and legs chocolate color, under side paler, mixed with ochraceous. Wings with the characters mentioned [in the key, p. 181, where they are said to have a bare area extending outside the axillary cell]; alula small; veins chestnut, 4th vein followed by a very distinct fold; another fold runs from tip of costa toward tip of 4th vein and forms a dark streak in the anterior half of its course. Length of body $6\frac{1}{2}$ mm.; of head and thorax combined 4 mm.; of wing $7\frac{1}{2}$ to 8 mm." Through the courtesy of Dr. L.R. Guimarães I was able to examine several cotypes of *L. raptatorum*, and recognized that they belong to *L. nigra* (Perty).

Lynchia albipennis (Say)

Figs. 5A, 63A-H, 64 and 65

Olfersia albipennis Say, 1823, Jl. Ac. Nat. Sci. Philadelphia, 3, p. 101 (no sex. United States: without precise locality, on *Ardea h. herodias*. Type lost); 1837, Oeuvres Entomologiques (ed. by Gory), p. 102; 1859, Complete Writings, (ed. by Le Conte), 2, p. 87. Osten Sacken, 1858, Cat. Dipt. North America, p. 86; 1878, Smithson. Misc. Coll., No. 270, p. 213. Brodie and White, 1883, Check List Ins. Dom. Canada, p. 57. Aldrich, 1905, Smithson. Misc. Coll., 46, No. 1444, p. 655. Speiser, 1907, Ent. News, 18, p. 104; 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 340. Johnson, 1913, Bull. Amer. Mus. Nat. Hist., 32, p. 90 (Florida: St. Augustine, on *Ardea herodias occidentalis*; Biscayne Bay). Swenk, 1916, Jl. New York Ent. Soc., 24, pp. 126 and 133 (Nebraska: Lincoln, on *Nycticorax nycticorax hoactli* [as *N. n. "naevius"*] and *Butorides v. virescens*; the latter fly, made "neotype," at Dept. Entom., Univ. Neb.). Johnson, 1922, Psyche, 29, p. 82 (Massachusetts: Allston, on *Nycticorax nycticorax hoactli*, New Jersey: records of 1900, 1910, as *O. ardeae*. Florida: records of 1913. [Hampston, N.H., record erroneous, based on *L. angustifrons*, as corrected by Johnson, 1925]). Wolcott, 1924, Jl. Dept. Agric. Porto Rico, 7, (for 1923), pt. 1, p. 234 (Puerto Rico: Río Piedras). Johnson, 1925, Occ. Papers Boston Soc. Nat. Hist., 7, p. 294 (Massachusetts: 1922 record). Zebrowski, 1932, Audubon Yearbook, Indiana Audubon Soc., p. 48. Wolcott, 1936, Jl. Agric. Univ. Puerto Rico, 20, pt. 1, p. 392. Muma, 1952, Bull. Univ. Nebraska State Mus., 3, pt. 3, p. 14 (the "neotype" selected by Swenk, 1916).

Lynchia albipennis Bequaert, 1933, Proc. California Ac. Sci., (4), 21, No. 11, p. 134. Peters, 1936, Bird-Banding, 7, p. 11 (Ohio: on *Nycticorax nycticorax hoactli*). Herman, 1937, Op. cit., 8, p. 164 (Massachusetts: North Eastham, on *Nycticorax nycticorax hoactli*). Thompson, 1938, Ent. Mo. Mag., 74, p. 46. J. Bequaert, 1940, Mem. Soc. Cubana Hist. Nat., 14, No. 4, pp. 322 and 323; 1940, Rev. Acad. Colombiana Cienc. Ex. Fis. Nat., 3, No. 12, p. 416; 1941, Occ. Papers Bernice P. Bishop Mus., Honolulu, 16, No. 11, pp. 280 and 282. Wolcott, 1941, Jl. Agric. Univ. Puerto Rico, 25, pt. 1, p. 121. J. Bequaert, 1942, Bol. Entom. Venezolana, 1, No. 4, p. 82; 1943, Jl. of Parasitology, 29, p. 135. Anduze, Pifano and Vogelsang, 1947, Bol. Entom. Venezolana, Num. Extra, p. 6. MacArthur, 1948, Bull. Publ. Mus. Milwaukee, 8, pt. 4, pp. 410 and 422, figs. 250-251 (Wisconsin: Fox River, Tichigan Marsh, Racine Co., on *Butorides v. virescens*. Illinois: Chicago, on *Botaurus lentiginosus*; McHenry, on *Botaurus lentiginosus*; Horseshoe Lake, on *Ardea h. herodias*; Decatur; Urbana; River Forest. Minnesota: Bald Eagle Lake, on *Botaurus lentiginosus*. Michigan: Manchester, on *Ixobrychus e. exilis*; Bass Lake, Livingston Co., on *Gallinula chloropus cachinnans*; Patterson Lake, Livingston Co., on *Botaurus lentiginosus*. Tennessee: Nashville, on *Gallinula chloropus cachinnans*). Thompson, 1949, Ent.

- Mo. Mag., 85, p. 248 (Jamaica: Rio Cobre Irrigation Canal, Grove Place, St. Catherine, on *Ardea h. herodias*; Bowden, St. Thomas, on *Nyctanassa v. violacea*). Wolcott, 1951, Jl. Agric. Univ. Puerto Rico, 32, (for 1948), pt. 3, p. 531.
- [? *Hippobosca metallica* Schummel, 1832, Uebersicht Arb. Veränd. Schlesisch. Ges. Vaterl. Cultur, p. 71 (Silesia: on *Botaurus stellaris*. Without description). *Nomen nudum*].
- Olfersia ardeae* Macquart, 1835, Hist. Nat. Ins. Dipt., 2, p. 640; Pl. 24, fig. 10 (no sex. Sicily: on a heron. Type probably lost). Schiner, 1864, Fauna Austriaca, Die Fliegen (Diptera), 2, p. 645. Loew, 1864, Amer. Jl. Sci. Arts, (2), 37, p. 318 (occurrence in North America). Walsh, 1864, Proc. Ent. Soc. Philadelphia, 3, p. 216. van der Wulp, 1867, Tijdschr. v. Entom., 10, p. 126 (Wisconsin). Osten Sacken, 1878, Smithson. Misc. Coll., No. 270, p. 213. Rondani, 1879, Bol. Soc. Ent. Italiana, 11, p. 22 (Italy: on *Ardea purpurca*, *A. cinerea* and *Botaurus stellaris*). Howard, 1883, South Carolina, Resources and Population, p. 275. Johnson, 1900, 27th Rept. New Jersey Bd. Agric., (for 1899), Suppl., p. 699 (New Jersey: Delaware River, on *Botaurus lentiginosus*, *Nycticorax nycticorax* *hoaetli*, and *Florida c. caerulea*). Washburn, 1905, Univ. Minnesota, Agric. Expt. Sta., Bull. 93, p. 163 (Minnesota: on *Botaurus lentiginosus*). Aldrich, 1905, Smithson. Misc. Coll., 46, No. 1444, p. 655. Speiser, 1907, Ent. News, 18, p. 104; 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 244, 245, and 304. Johnson, 1910, Ann. Rept. New Jersey State Mus., (for 1909), p. 814 (New Jersey: Bristol L., Delaware Riv.; other records as in 1900). Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 189 (copy of original description).
- Alfersia ardeae* Schiner, 1853, Verh. Zool. Bot. Ver. Wien, 3, Abhandl., pp. 153–154 (Czechoslovakia: Moravia, on *Botaurus stellaris*).
- Ornithoponus ardeae* Falcoz, 1926, Faune de France, 14, Diptères Pupipares, p. 32, figs. 30–31 (France: Ain, on *Botaurus stellaris*).
- Lynchia ardeae* Peters, 1936, Bird-Banding, 7, p. 11 (Alabama: on *Florida c. caerulea*). Brimley, 1938, Insects North Carolina, p. 390 (North Carolina: Raleigh, on *Casmerodius albus egretta*).
- Olfersia ardeae* Em. Blanchard, 1840, Hist. Nat. Insectes, 3, p. 631 (error for *ardeae* Macquart).
- Olfersia ardea* Thalhammer, 1900, Fauna Regni Hungariae, 3, Diptera, p. 69 (error for *ardeae* Macquart).
- Lynchia ardea* Peters, 1933, Bird-Banding, 4, p. 70 (Alabama: on *Florida c. caerulea*; error for *ardeae* Macquart).
- Olfersia propinqua* Walker, 1849, List Dipt. Brit. Mus., 4, p. 1141 (no sex; no host. Jamaica. Type ♀ at Brit. Mus.) Osten Sacken, 1858, Cat. Dipt. North America, p. 86; 1878, Smithson. Misc. Coll., No. 270, p. 213. Johnson, 1894, Proc. Ac. Nat. Sci. Philadelphia, p. 281. Austen, 1903, Ann. Mag. Nat. Hist., (7), 12, p. 265 (type. Refers to it van der Wulp's paratype of *Olfersia coriacea* from Presidio, Mexico). Aldrich, 1905, Smithson. Misc. Coll., 44, No. 1444, p. 656. Speiser, 1907, Ent. News, 18, p. 104; 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304. Gowdey, 1926, Dept. Agric. Jamaica, Ent. Bull., 4, pts. 1–2, p. 90.
- Lynchia propinqua* J. Bequaert, 1940, Mem. Soc. Cubana Hist. Nat., 14, No. 4, p. 323.
- Olfersia botauri* Rondani, 1879, Bol. Soc. Ent. Italiana, 11, p. 22 (no sex. Central Italy: on *Ardea purpurea*. Type at Natural History Museum in Florence, labelled as from Liguria).
- Olfersia coriacea* van der Wulp, 1903, Biol. Centr.-Amer., Diptera, 2, p. 430 (in part: paratype of the species, from Mexico: Presidio).
- Olfersia palustris* Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 183; Pl. 28, fig. 4 (no sex. Brazil: Piauh, on *Casmerodius albus egretta* [“*Herodias egretta*”], *Tigrisoma lineatum marmoratum* [“*Tigri-*

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- soma brasiliense*''], *Cochlearius c. cochlearius* [“*Cancroma cochlearia*”] and *Mesembrinibis cayennensis* [“*Harpiprion cayennensis*”]; Rio São Francisco, on *Casmerodius albus egretta* [“garça branca”]; Lassance, Est. Minas Gerais, on *Ardea cocoi* [“*Ardea socoi*”]. Types at Inst. Osw. Cruz, Rio de Janeiro). Ad. Lutz and Nuñez-Továr, 1928, *Estudios Zoológica Parasitología Venezolanas*, p. 9 (Venezuela: on several herons). Carbonell, 1938, *Parasitología en Venezuela y los Trabajos del Dr. M. Nuñez-Továr*, p. 251. Not of J. Bequaert, 1933*b*, p. 71.
- Lynchia palustris* Martorell, 1939, *Jl. Agric. Univ. Puerto Rico*, **23**, p. 221.
- Olfersia botaurinorum* Swenk, 1916, *Jl. New York Ent. Soc.*, **24**, pp. 128 and 133 (no sex. Nebraska: Omaha, holotype and paratype on *Ixobrychus e. exilis*; Lincoln, paratype on *Botaurus lentiginosus*. Types, all ♀, at Dept. Ent., Univ. Nebraska, Lincoln). Muma, 1952, *Bull. Univ. Nebraska State Mus.*, **3**, pt. 3, p. 14 (holotype only listed).
- Lynchia botaurinorum* Peters, 1936, *Bird-Banding*, **7**, p. 11 (New Hampshire: on *Casmerodius albus egretta*. South Carolina: on *Leucophoyx t. thula*. Ohio: on *Botaurus lentiginosus*). Thompson, 1936, *Ann. Mag. Nat. Hist.*, (10), **18**, p. 309 (Mexico: Orizaba, with 5 Mallophaga, *Ardeicola botauri*, attached).
- Lynchia botaweirorum* Strickland, 1938, *Canad. Jl. Res.*, Sect. D, **16**, p. 219 (Alberta: on *Botaurus lentiginosus*). Error for *L. botaurinorum*.
- Olfersia scutellaris* Swenk, 1916, *Jl. New York Ent. Soc.*, **24**, pp. 129 and 133 (no sex. Michigan: Watkins' Station near Manchester, on *Ixobrychus e. exilis*. Type ♀ at Dept. Entomology, Univ. Nebraska, Lincoln). Muma, 1952, *Bull. Univ. Nebraska State Mus.*, **3**, pt. 3, p. 14 (type).
- Olfersia intertropica* Swenk, 1916, *Jl. New York Ent. Soc.*, **24**, pp. 129 and 133 (Mexico: Orizaba; specimen seen in Swenk Coll.). Not of Walker, 1849.
- Ornithoponus intertropicus* Johnson, 1924, *Zoologica*, New York, **5**, pt. 8, p. 91 (Galapagos: Seymour Bay, Indefatigable I., on *Butorides sundevalli*). Curran, 1932, *Nyt Mag. Naturvidenskab.*, **71**, p. 366. Not of Walker, 1849.
- Lynchia setosa* Ferris, 1927, *Philippine Jl. Sci.*, **34**, p. 224, figs. 14 and 15a-c (Philippine Islands: Palawan, ♂ holotype on *Bubulcus [ibis] coromandus*; Lucban, Tayabas Province, Luzon, ♀ allotype on same host. Types in Stanford Univ. Museum, Palo Alto, California); 1930, *Op. cit.*, **43**, p. 552 (Philippines: Manila, ♂ on *Circus* sp.; Obando, Bulacan Prov., Luzon, ♂ on *Ixobrychus [sinensis] astrologus*).
- Lynchia massonati* O'Mahony, 1940, *Jl. Soc. British Ent.*, **2**, pt. 2, p. 75 (Ireland: Enniscorthy, Co. Wexford, on *Ixobrychus m. minutus*. I have seen this specimen). Not of Falcoz, 1926.

Distribution and Specimens Examined. DOMINION OF CANADA.

ALBERTA (recorded by Strickland, 1938, as *L. botaurinorum*): Belvedere, Edmonton Co., 54° N., on *Botaurus lentiginosus* (C.G. Harold). — BRITISH COLUMBIA: Wasa, 49° 48' N., on *Botaurus lentiginosus* (J. Poole). — MANITOBA: Birtle, 50° 26' N., on *Botaurus lentiginosus* (R.D. Bird). — ONTARIO: Wellington, 43° 58' N., on *Botaurus lentiginosus* (C.H.D. Clarke); Point Pelée, Essex Co., 41° 54' N., on *Botaurus lentiginosus* (A.D. Andrews); Toronto, on *Ixobrychus e. exilis* (H. Southam); Dwight, Muskoka Co., 45° 20' N. (F.P. Ide). — QUEBEC: Montreal, on *Botaurus lentiginosus* (J. Ouellet); Kamouraska (au Moulin), Kamouraska Co., 47° 35' N.,

on *Anas crecca carolinensis* (W. La Brie) ; Ile Perrot, 45° 20' N., on *Botaurus lentiginosus*, Nov. 1 (Fr. Lionel Philippe).

UNITED STATES. ALABAMA (recorded by Peters, 1933 and 1936, as *L. ardeae*) : Dauphin I., Mobile Co., on *Florida c. caerulea*, June 9 (H.S. Peters). — FLORIDA (recorded by Johnson, 1913, 1922) : Biscayne Bay, Dade Co. (Mrs. A. Slosson) ; Eau Gallie, Brevard Co., (W.W. Worthington) ; Bowlogs Key, on *Ardea herodias occidentalis*, Feb. 5 (E.G. Holt) ; Levy Co. (P. Laurent) ; St. Augustine, Alachua Co., on *Ardea herodias occidentalis*, Nov. 8 (C.W. Johnson) ; Richmond, 20 miles S. of Miami, Dade Co., on Man (W.W. Wirth) ; Myakka River, Sarasota Co., on *Florida c. caerulea* (L.R. Penner). — GEORGIA : Brunswick, Glynn Co., on *Hydranassa tricolor ruficollis* (Mrs. R.C. Simpson) ; Griffin, Spalding Co. (C.M. Beckham) ; [Savannah, Chatham Co., on *Casmerodius albus egretta* ; Cleveland, White Co. — Recorded by P.W. Fattig, *in litt.* ; not seen]. — ILLINOIS (recorded by MacArthur, 1948) : without precise locality (C.W. Johnson) ; N. Dearborn, Chicago, on *Botaurus lentiginosus* ; River Forest, Cook Co. (W. Mann) ; Grant Park, Chicago, 1 ♂ 6 ♀ on *Botaurus lentiginosus*, Aug. 3 ; McHenry, McHenry Co., on *Botaurus lentiginosus* (J. Friesser) ; Decatur, Macon Co., on *Botaurus lentiginosus* ; Urbana, Champaign Co. — INDIANA : without precise locality (C.W. Johnson). — IOWA : Ames, Story Co., on *Ardea h. herodias*, Apr. 16 ; Iowa City, Johnson Co. (H.F. Wickham) ; Ruthven, Palo Alto Co., on *Botaurus lentiginosus* (Frances Hamerstrom). — KANSAS : without precise locality, on *Nycticorax nycticorax hoactli* ; Riley Co. (E.A. Popenoe) ; Douglas Co., on *Porzana carolina* (A. Wetmore), *Ardea h. herodias*, Apr. 15 (T. Rockland), and *Porphyryula martinica* (R.H. Burt). — LOUISIANA : Cameron, Cameron Co., on *Butorides v. virescens*, Dec. 14 (S.H. Roberts) ; Creole, Cameron Co., on *Botaurus lentiginosus*, Nov. 21 (W.W. Wirth). — MARYLAND : Bowie, Patuxent Research Refuge, Prince Georges Co., on *Tringa melanoleuca* (R.T. Mitchell) ; Marshall Hall, Charles Co., Aug. 7 (A.N. Caudell). — MASSACHUSETTS (recorded by Johnson, 1922 ; Herman, 1937) : North Eastham, Barnstable Co., on *Nycticorax nycticorax hoactli* (C.M. Herman) ; Springfield, Hampden Co. (G.A. Allen) ; Woods Hole, Barnstable Co., on *Nycticorax nycticorax hoactli*, Aug. 15 (G.A. McCallum) ; Chatham, Barnstable Co., on *Tringa melanoleuca*, Apr. 26 (R.P. Dow) ; Allston, Boston, on *Nycticorax nycticorax hoactli*, Aug. 1 (C.W. Johnson). — MICHIGAN (recorded by Swenk, 1916, as *O. scutellaris* ; MacArthur, 1948) : Silver Lake Park, Oceana Co. (A.L. Olson and L.K. Gloyd) ; Paterson Lake, Livingston Co., Sept. 30, on *Botaurus lentiginosus* (J.

Van Tyne); Bass Lake, Putnam, Livingston Co., on *Gallinula chloropus cachinnans* (J. Van Tyne); Watkins Station near Manchester, Washtenaw Co., on *Ixobrychus e. exilis* (type of *scutellaris* Swenk. — R.H. Wolcott). — MINNESOTA (recorded by Washburn, 1905, as *O. ardeae*; MacArthur, 1948): Lake Minnetonka, Hennepin Co., June 19 (F.M. Uhler); Excelsior, Hennepin Co. (F.M. Uhler); Bald Eagle Lake, on *Botaurus lentiginosus* (R.W. Macy); Saint Paul, Ramsey Co., on *Botaurus lentiginosus* (S. Kepperley); Dr. Ohage's Place, on *Botaurus lentiginosus*, May 9, 1898. — MISSISSIPPI: Hindsboro, Harrison Co., on *Butorides v. virescens*, Apr. 24 (G.G. Rohwer); Oxford, Lafayette Co. (F.M. Hull). — MISSOURI: St. Louis, on *Butorides v. virescens*, May 12 (R.C. Froeschner); Hollister, Taney Co., Apr. (H.H. Knight). — MONTANA: Ravalli Co., on *Botaurus lentiginosus* (L. Humble). — NEBRASKA (recorded by Swenk, 1916, as *O. botaurinorum*): Lincoln, Lancaster Co., on *Botaurus lentiginosus* (♀ paratype of *botaurinorum*. — J.C. Crawford), *Nycticorax nycticorax hoactli* (L. Bruner), and *Butorides v. virescens* (J.S. Hunter, ♀ selected by Swenk as "neotype" of *albipennis* Say; J.T. Zemmer); Omaha, Douglas Co., on *Ixobrychus e. exilis* (♀ holotype and ♀ paratype of *botaurinorum*. — R.H. Wolcott); Garden Co., on *Nycticorax nycticorax hoactli* (A.M. Brooking); Glenville, Clay Co., on *Botaurus lentiginosus* (A.M. Brooking). — NEW HAMPSHIRE (recorded by Peters, 1936, as *botaurinorum*): Hinsdale, Cheshire Co., on *Casmerodius albus egretta* (H.S. Peters). — NEW JERSEY (recorded by Johnson, 1900, 1910, as *O. ardeae*): Bristol I., Delaware River, on *Florida c. caerulea* (Fowler); Ramsey, Bergen Co. (L. Hook). — NEW YORK: Ithaca, Tompkins Co., on *Botaurus lentiginosus*; West Point, Orange Co., Apr. 8 (W. Robinson); West Nyack, Rockland Co., on *Botaurus lentiginosus*, May 3; Orient, Long Island, on *Butorides v. virescens*, June 1, *Florida c. caerulea*, Sept. 3, *Pandion haliaetus carolinensis*, and *Nyctanassa v. violacea* (R. Latham); Delmar, Albany Co., on *Nycticorax nycticorax hoactli* (E.J. Gerberg); Branchport, Yates Co., on *Botaurus lentiginosus* (V. Burtsch); Greenport, Long Island, on *Botaurus lentiginosus*, Sept. 18 (R. Latham); Northwest, Long Island, on *Butorides v. virescens*, June 30 (R. Latham); Mt. Sinai, Long Island, on *Butorides v. virescens* (R.C. Murphy). — NORTH CAROLINA (recorded by Brimley, 1938, as *L. ardeae*): Raleigh, Wake Co., Apr. 8 (C.S. Brimley) and on *Casmerodius albus egretta* (H.H. Brody) and *Ixobrychus e. exilis*, Aug. 7 (C.S. Brimley); Orton Point (D.L. Wray). — OHIO (recorded by Peters, 1936, as *L. botaurinorum*): Greenville, Darke Co., on *Butorides v. virescens*

(R. Rausch); Buckeye Lake, Parry Co., on *Nycticorax nycticorax hoactli*, Apr. 26 (H.S. Peters); Wilmington, Clinton Co., on *Mycteria americana* (R.M. Goslin); Toledo, Lucas Co., on *Botaurus lentiginosus* (L.W. Campbell); Columbus, Franklin Co., on *Falco s. sparverius* (A. Stupka); Kirtland, Lake Co., Dec. 7, on *Botaurus lentiginosus* (F.C. Bishopp). — OKLAHOMA: Stillwater, Payne Co. (J.M. Maxwell). — PENNSYLVANIA: West Chester, Chester Co., on *Ardea h. herodias* (R.M. Stabler); Harrisburg, Dauphin Co. (W.R. Walton); Reading, Berks Co., on *Accipiter striatus velox* (L.S. Dillon); Hiner, Clinton Co., on *Botaurus lentiginosus* (G. Link); Sewickley, Allegheny Co., on *Botaurus lentiginosus* (W.E.C. Todd); Pittsburgh, Allegheny Co.; Philadelphia, on *Botaurus lentiginosus* (C.W. Johnson); Philadelphia Neck, on *Botaurus lentiginosus*, Oct. 12, and *Ixobrychus e. exilis* (C.W. Johnson); eastern Pennsylvania, on *Nycticorax nycticorax hoactli* (C. Liebeck). — SOUTH CAROLINA (recorded by Peters, 1936, as *L. botaurinorum*): Central, Pickens Co., on *Botaurus lentiginosus* (D. Dunavan); Clemson College, Oconee Co. (S. Williamson); Santee, Charleston Co., on *Tyto alba pratincola* (R.E. Bishop); Florence, Florence Co., on *Florida c. caerulea*; James I., Charleston Co., on *Butorides v. virescens* (E.R. Kalmbach); Heron I. near Charleston, Charleston Co., on *Leucophoyx t. thula*, July 3 (E.M. Batton and G.R. Lunz). — SOUTH DAKOTA: Brookings, Brookings Co., 4 flies on *Ixobrychus e. exilis*, May 21 (N. Hartwig); 20 miles N. of Watertown, Codington Co., on *Botaurus lentiginosus* (G.B. Spawn). — TENNESSEE (recorded by MacArthur, 1948): Nashville, Davidson Co., on *Gallinula chloropus cachinnans* (Mrs. A.R. Laskey). — TEXAS: Kennedy Co., on *Nyctanassa v. violacea*, Aug. 19; Galveston, Galveston Co., on *Hydranassa tricolor ruficollis*, June 14, and *Dichromanassa v. rufescens*, July 24 (R.W. Strandtmann). — VIRGINIA: Great Falls, Fairfax Co., on *Piranga r. rubra* (A. Wetmore). — WASHINGTON (STATE): Pullman, Whitman Co., Oct. 6 (L.R. Campbell). — WISCONSIN (recorded by van der Wulp, 1867, as *O. ardeae*; MacArthur, 1948): Mink River, Door Co., on *Ixobrychus e. exilis*, June (W.J. Woodman); Fox River, Tichigan Marsh, Racine Co., on *Butorides v. virescens* (K.W. MacArthur); Milwaukee, Milwaukee Co., on *Ixobrychus e. exilis*, May 19 (W. Pelzer); Mahomet, Champaign Co., on *Butorides v. virescens*, May 11 (G. W. Hahn); Racine, Racine Co., 3 ♀ on *Botaurus lentiginosus*, May 7 (E.J. Rokosky). — WYOMING: without precise locality, on *Ixobrychus e. exilis*.

MEXICO (recorded by van der Wulp, 1903, as *O. coriacea*; Swenk, 1916, as *O. intertropica*; Thompson, 1936, as *O. botaurinorum*): San

Gabriel Bay, Baja California, on *Ardea herodias sanctilucae*, Feb. 13 (G. Augustson); Río Usumacinta near Frontera, State Tabasco, on *Mycteria americana* (C.H.T. Townsend); Ebano, State San Luis Potosi, on *Botaurus lentiginosus* (R.J. Newman); Orizaba, State Vera Cruz (A. Sallé, with 5 *Degeeriella botauri* attached, as recorded by Thompson, 1936; L. Bruner, Swenk's supposed *intertropica*); Presidio [not located by State] (van der Wulp's supposed ♂ paratype of *O. coriacea*).

REPUBLIC OF HONDURAS: Puerto Castilla, on *Ardea herodias occidentalis* (R.H. Painter).

PANAMA: Ancon, C.Z., on Man (A.H. Jennings); Cristobal, C.Z.; Puerto de Chorrera, Panama Prov., R.P., on *Cochlearius cochlearius panamensis* (W.W. Middlekauff).

ANTILLES. BAHAMAS: Nurse Cay, Ragged I., on *Butorides virescens bahamensis* (H.S. Peters). — CUBA: without precise locality (P. Poey). — ISLE OF PINES: Los Indios, on *Guara alba* (G. Link). — JAMAICA (recorded by Walker, 1849, as *O. propinqua*; Thompson, 1949): without precise locality (Walker's ♀ type of *propinqua*); near Salt I., St. Catherine, on *Casmerodius albus egretta* (F. Romney); Black River, St. Elizabeth, on *Leucophoyx t. thula* (R.P. Bengry); Rio Cobre Irrigation Canal, Grove Place, St. Catherine, on *Ardea h. herodias* (G.B. Thompson); Bowden, St. Thomas, on *Nyctanassa v. violacea* (G.B. Thompson); Falmouth, on *Butorides virescens maculatus* (H.D. Carroll). — PUERTO RICO (recorded by Wolcott, 1924, 1936, 1941, 1951): Río Piedras (A. Wetmore).

COLOMBIA: Don Diego, Dept. Magdalena (H.H. Smith); Intendencia del Meta, on *Leucophoyx t. thula* ["*Ardea nivea*"] (B. Guevara).

VENEZUELA (recorded by Lutz and Nuñez-Továr, 1928).

BRITISH GUIANA: Takutu River, on *Theristicus caudatus* (J.G. Myers).

BRAZIL (recorded by Lutz, Neiva and da Costa Lima, 1915, as *O. palustris*): near Cachoeira, State Rio Grande do Sul, on *Anas brasiliensis* (W.F. Henninger); São Sebastião, State São Paulo; Lassance, State Minas Gerais, ♀ cotype of *O. palustris*, on *Ardea cocoi* (Mus.Comp.Zool., from Ad. Lutz); Parnaguá, State Piauhý including some cotypes of *O. palustris*, on *Mesembrinibis cayennensis*, *Casmerodius albus egretta*, *Tigrisoma lineatum marmoratum*, and *Leucophoyx t. thula* (Inst.Osw.Cruz); Martinho, State Matto Grosso, on *Leucophoyx t. thula* (T. Borgmeier); Cana Brava, State Goyaz (José Blaser); State São Paulo, on *Rhinoptynx c. clamator* (Juliani); Rio Paranapanema, State São Paulo, on *Tigrisoma linea-*

tum marmoratum (E. Dente); Pau Gigante, State Espirito Santo, on *Cochlearius c. cochlearius* (E.G. Holt); Rio Paraná, State Matto Grosso; Rio das Mortes, S. Domingos, State Matto Grosso, on *Eurypyga h. helias* (Werner). (Specimens for the last 5 records received from the Departamento de Zoologia, São Paulo, through Dr. L.R. Guimarães).

GALAPAGOS (recorded by Johnson, 1924, as *O. intertropicus*; Curran, 1932, as *O. intertropicus*): Narborough I., on *Ardea herodias cognata* (M. Willows, Jr.); James I. (M. Willows, Jr.); North Seymour I. (M. Willows, Jr.); Tower I., on *Nyctanassa violacea pauper* (G. Augustson; W.S. Brooks); Seymour Bay, Indefatigable I., on *Butorides sundevalli* (W. Beebe); Albemarle I., on *Butorides sundevalli*; 10 miles S.W. of Elizabeth Bay, Albemarle I., on *Nyctanassa violacea pauper* (J.P. Chapin); Conway Bay, Indefatigable I., on *Butorides sundevalli* and *Larus fuliginosus* (J.P. Chapin).

PARAGUAY: Chaco (K. Fiebrig).

ARGENTINA: Dept. Tucumán, Tucumán, 1 ♀ on *Syrigma sibilatrix*, July 10 (O. Budin).

L. albipennis is nearly cosmopolitan, but mainly in tropical and warm temperate regions, and is apparently one of the few insects that have become world-wide without the assistance of Man. Its northmost extension is in the New World, where it reaches 54° N. in Alberta. There is as yet no record from California, where it has no doubt only been overlooked. The southmost record is from 30° S., in southeastern Brazil. In the Old World, where it is usually called *L. ardeae*, it is particularly common in Africa, with definite records from Tunis, Egypt, the eastern Sudan, Eritrea, Northern Nigeria, Southern Nigeria, Gold Coast, Belgian Congo, Uganda, Kenya, Tanganyika Territory, Southern Rhodesia, Nyasaland and Transvaal. It is probably found normally in all countries bordering the Mediterranean, there being records from southern France, Italy, Sicily, Macedonia, Bulgaria, southern Russia and Rhodes. Its occurrence farther north is only accidental, as shown by the few sporadic captures in Czechoslovakia, East Prussia, the Netherlands, England and Ireland. Elsewhere in the Old World it is known also from Madagascar, southern Arabia, Siam, the Philippines, Australia, Manchuria (Yalu River), and Japan.

Known Nearctic Hosts of *L. albipennis* (verified individual records in parentheses). Ciconiiformes (82): *Ardea h. herodias* (3); *A. herodias occidentalis* (2); *Botaurus lentiginosus* (33); *Butorides v. virescens* (12); *Casmerodius albus egretta* (2); *Dichromanassa*

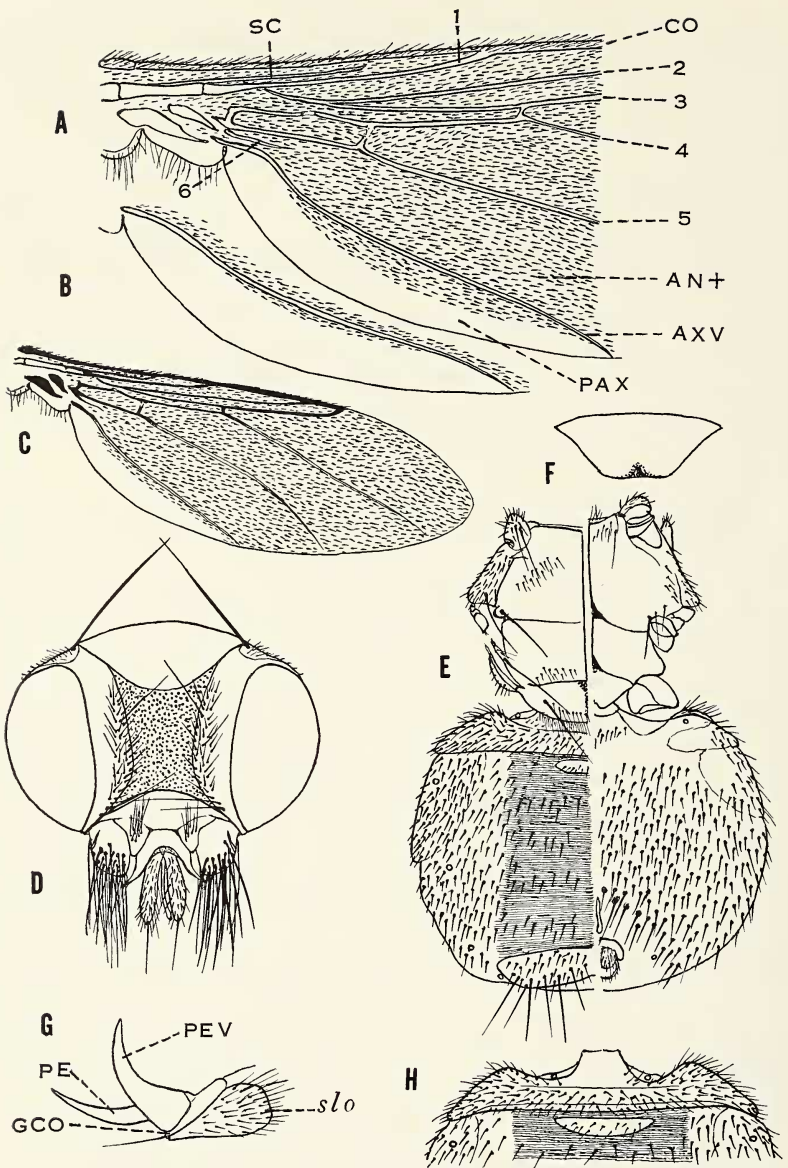


Fig. 63. *Lynchia albipennis* (Say). A, basal half of wing ♀, Ravalli Co., Mont., on *Botaurus lentiginosus*: AN+, combined anal, 3rd posterior and axillary cells; AXV, axillary vein; CO, costa; PAX, postaxillary cell; SC, subcosta; 1, 2, 3, 4, 5, and 6, 1st, 2nd, 3rd, 4th, 5th, and (remaining stump of)

r. rufescens (1); *Florida c. caerulea* (5); *Hydranassa tricolor ruficollis* (2); *Ixobrychus e. exilis* (9); *Leucophoyx t. thula* (1); *Mycteria americana* (1); *Nyctanassa v. violacea* (2); *Nycticorax nycticorax hoactli* (9). Anseriformes (1): *Anas crecca carolinensis* (1). Falconiformes (3): *Accipiter striatus velox* (1); *Falco s. sparverius* (1); *Pandion haliaetus carolinensis* (1). Gruiformes (4): *Galinula chloropus cachinnans* (2); *Porphyryla martinica* (1); *Porzana carolina* (1). Charadriiformes (2): *Tringa melanoleuca* (2). Strigiformes (1): *Tyto alba pratincola* (1). Passeriformes (1): *Piranga r. rubra* (1).

Known Neotropical Hosts of *L. albipennis*. Ciconiiformes (30): *Ardea cocoi* (1); *A. h. herodias* (1); *A. herodias cognata* (1); *A. herodias occidentalis* (1); *A. herodias sanctilucae* (1); *Botaurus lentiginosus* (1); *Butorides sundevalli* (3); *B. virescens bahamensis* (1); *B. virescens maculatus* (1); *Casmerodius albus egretta* (2); *Cochlearius c. cochlearius* (1); *C. cochlearius panamensis* (1); *Guara alba* (1); *Leucophoyx t. thula* (4); *Mesembrinibis cayennensis* (1); *Mycteria americana* (1); *Nyctanassa v. violacea* (1); *N. violacea pauper* (3); *Syrigma sibilatrix* (1); *Theristicus caudatus* (1); *Tigrisoma lineatum marmoratum* (2). Anseriformes (1): *Anas brasiliensis* (1). Gruiformes (1): *Eurypyga h. helias* (1). Charadriiformes (1): *Larus fuliginosus* (1). Strigiformes (1): *Rhinopteryx c. clamator* (1).

The following list of known Old World hosts is based on unpublished as well as published records: Ciconiiformes: *Ardea c. cinerea*; *A. cinerea firsas*; *A. goliath*; *A. melanocephala*; *A. p. purpurea*; *A. s. sumatrana*; *Ardeola ralloides*; *Botaurus s. stellaris*; *Bubulcus i. ibis*; *B. ibis coromandus*; *Casmerodius albus melanorhynchus*; *C. albus modestus*; *Egretta dimorpha*; *E. g. garzetta*; *Ibis ibis*; *Ixobrychus m. minutus*; *I. sinensis astrologus*; *Mesophoyx i. intermedia*; *Nycticorax n. nycticorax*. Falconiformes: *Circus* sp. Charadriiformes: *Actophilornis africana*; *Xiphidiopterus albiceps*.

Bionomics. In the New as well as in the Old World, *L. albipennis* is primarily a parasite of wading birds (Ciconiiformes), with

6th longitudinal veins; **B**, axillary vein and postaxillary cell, ♀, Ancon, Panama; **C**, wing, ♂, Indefatigable I., Galapagos, on *Butorides sundevalli*; **D**, head, ♀, Philadelphia, Pa., on *Botaurus lentiginosus*; **E**, thorax and abdomen dorsally and ventrally, ♀, Ravalli Co., Mont., on *Botaurus lentiginosus*; **F**, postvertex, ♀, Narborough I., Galapagos, on *Ardea herodias cognata*; **G**, ♂ terminalia, Brookings, S. Dak., on *Ixobrychus e. exilis*; **GCO**, rudiment of gonocoxite; **PE**, penis; **PEV**, penis valve; **slo**, setigerous lobe at side of genital atrium; **H**, dorsal basal area of abdomen, ♂, Puerto Castilla, Honduras, on *Ardea herodias occidentalis*.

89 per cent of the verified individual records of the New World referring to this Order. Such birds appear to be its only regular breeding hosts. Although it strays occasionally to other birds with a similar ecology (Charadriiformes, Gruiformes, Anseriformes), which also prefer a marshland or aquatic environment, particularly for nesting, it is doubtful whether any of these serve as normal breeding hosts, in view of the few sporadic records. On other types of recorded hosts, such as owls, diurnal birds of prey and tanagers, the fly is clearly accidental and some of the records from them may be based on *post mortem* contaminations. The nearly cosmopolitan distribution of *L. albipennis* is no doubt due to the powerful flight of its regular breeding hosts, some of which undertake wide-ranging migrations or occur in several races on all continents.

At present the overwhelming majority of verified American records are from some of the smaller wading birds, such as bitterns (*Botaurus*, *Ixobrychus*), green herons (*Butorides*) and night herons (*Nycticorax*, *Nyctanassa*). This is due, however, to the vagaries of collecting, not to any real preference shown for such birds. Hippoboscids are much more difficult to collect from the larger wading birds, some of which, moreover, are often rare or restricted in distribution.

Some of the ecological peculiarities of *L. albipennis* were mentioned in Part I, such as infestation with mites (pp. 146 and 156), phoresy of Mallophaga (p. 173) and host preferences (pp. 252 and 320).

In temperate North America *L. albipennis* seems to be absent during the winter. Most flies were collected there during May, June, July, August and September, and a few also in April and October. In the northern United States the earliest recorded date is April 8 (New York) and the latest December 7 (Ohio); but farther south there are also records in Louisiana for November 21 and December 14, and in Florida for February 5 and November 8. In the more northern parts of its range the fly must probably be introduced anew every spring on migrant hosts.

The following may be added to the 6 cases listed before of infestation with mites:

7. A female from Florence, South Carolina, taken on *Florida c. caerulea*, carried 2 mite clusters on the abdomen; a male taken with it was free of mites.

8. A female from Lincoln, Nebraska, (paratype of *O. botaurinorum*), taken on *Botaurus lentiginosus*, carried a female mite, without eggs, on the side of the abdomen near the tip.



Fig. 64. *Lynchia albipennis* (Say), basal area of wing, ♂, Chicago, Ill., on *Botaurus lentiginosus*. Photograph by Mr. K. MacArthur (1948, fig. 250).

The puparium, as well as its location in nature, are as yet unknown.⁴⁸

Affinities. In the present paper the small specimens of *Lynchia* normally found on wading birds throughout the world, are considered to belong to a single, cosmopolitan species, under the oldest available name, *L. albipennis* (Say). This conclusion was reached after studying over 400 specimens from a large variety of waders over a very wide territory, as it was found impossible to divide these consistently on constant and reliable structural differences. It was

⁴⁸ The statement in Part I (p. 194) about the supposed occurrence of the puparium in the nest of the European bittern should be deleted. It was taken from Brauer (1883, p. 93), who credited it to Schiner (1864, 2, p. 647); but I have been unable to find it either in the work quoted by Brauer or in any other of Schiner's writings.

therefore necessary to synonymize with *albipennis* 6 names based by later writers on flies from the same type of host, as well as one (*O. propinqua*) from an unknown host. The synonymies are further discussed below in connection with the original descriptions.

In *L. albipennis* the course of the subcosta varies more than usual in the genus. As it is easily observed, one may be tempted to use its variations to subdivide the species; but the following considerations show that it is unreliable for this purpose.

A random sample of 77 New World specimens may be divided as follows:

a. Flies with subcosta complete (ending clearly in the costa) in both wings (Fig. 63C): 37 (20 ♀ and 17 ♂), from Quebec, Florida, Kansas, Massachusetts, Michigan, Minnesota, Nebraska, New York, Pennsylvania, South Carolina, Texas, Panama, Jamaica, Colombia, Paraguay, Brazil and Galapagos, taken on *Anas crecca carolinensis*, *Ardea h. herodias*, *A. herodias cognata*, *Botaurus lentiginosus*, *Butorides sundevalli*, *B. v. virescens*, *Hydranassa tricolor ruficollis*, *Leucophoyx t. thula*, *Nyctanassa violacea pauper*, *Nycticorax nycticorax hoactli*, *Syrigma sibilatrix*, and *Tigrisoma lineatum marmoratum*. This group includes several of the cotypes of *O. palustris*; but, as Lutz, Neiva and da Costa Lima (1915) noted, in other cotypes the subcosta was incomplete and they concluded that the character was unreliable.

b. Flies with subcosta incomplete (ending freely in the membrane) in both wings (Fig. 63A): 27 (16 ♀ and 11 ♂), from Quebec, Illinois, Massachusetts, Michigan, Minnesota, Montana, Nebraska, New Jersey, New York, Pennsylvania, South Dakota, Wisconsin, Honduras, Brazil and Galapagos, taken on *Anas crecca carolinensis*, *Ardea herodias occidentalis*, *Butorides v. virescens*, *Botaurus lentiginosus*, *Florida c. caerulea*, *Ixobrychus e. exilis*, *Nycticorax nycticorax hoactli* and *Pandion haliaetus carolinensis*. This group includes the types of *O. botaurinorum* and *O. scutellaris*.

c. Flies with the subcosta complete in one wing and incomplete in the other: 14 (9 ♀ and 5 ♂), from British Columbia, Ontario, Florida, Massachusetts, Missouri, North Carolina, Ohio, Texas, Wisconsin, Jamaica and Brazil, taken on *Ardea herodias occidentalis*, *Botaurus lentiginosus*, *Butorides v. virescens*, *Dichromanassa r. rufescens* and *Totanus melanoleuca*. While in most of these flies the vein is abruptly cut off and distinctly separated from the costa, in some the separation is very narrow or almost imperceptible, particularly when the vein becomes gradually thinner at the tip. The two conditions intergrade so completely that some flies have to be



Fig. 65. *Lynchia albipennis* (Say), terminalia of ♂, Chicago, Ill., on *Botaurus lentiginosus*. Photograph by Mr. K. MacArthur (1948, fig. 251).

placed arbitrarily; such is the case, for instance, for the type of *O. propinqua*, as discussed in the sequel.

While the total number of flies examined is too small for further statistical analysis, it is nevertheless significant that the costa is incomplete in both wings in about half of them, complete in both wings in about one-third, and incomplete in only one wing in less than one-fourth. None of the three groups shows any tendency to prefer a special geographical area or a particular type of host. In fact, all three groups have been found on *Ardea herodias*, *Botaurus lentiginosus* and *Butorides virescens*; while *Anas crecca* and *Nycticorax nycticorax* are represented in two of them. A study of additional Old World flies from waders leads to the same results.

Of particular interest are cases in which 2 or more flies taken from the same individual bird differ in this character. Of 2 ♀ from São Sebastião, Brazil, taken together on an unknown host, one had the subcosta incomplete in both wings, the other had it complete in one wing and incomplete in the other. Of a pair taken at Kamouraska, Quebec, on *Anas crecca carolinensis*, the ♂ had the subcosta

complete, and the ♀ had it incomplete in both wings. Of 2 ♀ of Delmar, N.Y., from *Nycticorax nycticorax hoactli*, one had it complete and the other incomplete in both wings.

It should be pointed out that it has been impossible to correlate with any degree of certainty the type of subcosta with the variations of other characters, to be discussed presently.

When the subcosta is complete, the position of its tip on the costa in relation to that of the anterior basal cross-vein is most variable. Often it is nearly opposite the cross-vein (Fig. 63C); but sometimes it is slightly basad or decidedly apicad. When the vein is incomplete, it usually ends about opposite the cross-vein (Fig. 63A); but sometimes it is shortened and may then stop in the membrane far basad of the cross-vein.

While the postvertex does not vary as much in contour as in *L. americana*, its anterior margin shows considerable variation. All stages may be observed connecting the two extremes, from completely smooth, merely rounded truncate and only slightly depressed at apex (Fig. 63D) to deeply emarginate, with the roughly triangular notch coarsely punctate (Fig. 63F).

The sexes differ little, the width of the interocular face in particular being about the same in both. The dorsum of the abdomen of ♀ and ♂ bears in the striated area one smooth median sclerite, a short distance apicad of the fused basal laterotergites; this sclerite is larger in the ♂ (Fig. 63H), being relatively wider (transversely) than in the ♀. The median sclerite may escape observation, as it is sometimes hidden beneath the hind margin of the basal laterotergites through contraction of the soft integument (as in Ferris' figure of *L. setosa*, 1927c, p. 227).

Original description of *O. albipennis*: "Blackish-brown; wings whitish. Mentum white; thorax with the cruciate lines distinct, the longitudinal line tinged with yellow, humeral tubercle prominent, pale, obtuse; scutellum with an impressed line; nervures brown, inner cellule [2nd basal cell] less than half as long as the preceding one [1st basal cell] which extends to the base of the wing; tergum pale-brownish, with a black base, disk and tip. Length $\frac{1}{2}$ inch [= 5 mm. J.]" The type is lost, so far as known. That the species belongs in the genus now called *Lynchia*, is shown by Say's placing it in *Olfersia* (which at that time contained the species now placed in *Lynchia*) and by his statement that the 2nd basal cell is considerably shorter than the 1st. The size he gives refers it to one of the smaller species; but the description mentions no truly specific character. The other North American small species, *L. angustifrons*, *L. hirsuta* and *L. holoptera*, may, however, be ruled out, if it is accepted that only one species of *Lynchia* breeds normally on North American wading birds. If, however, these birds were found to harbor two or more small species of *Lynchia*, as Swenk (1916) thought, Say's name should be applied arbitrarily to one of them. Swenk actually did this by selecting and redescribing as "neotype" a ♀ taken on *Butorides v. virescens* at Lincoln, Nebraska. For the con-

venience of future workers, who may be inclined to agree with Swenk, I copy his new description, based in part also on two flies taken at Lincoln on *Nycticorax nycticorax hoactli* (cited by him as *N. n. naevius*): "Length 5 mm., the head and thorax alone measuring 2.75 mm., and the distance from the front of the head to the tip of the wing measuring 7 mm., the thorax being 2 mm. wide at the widest part. Head and thorax blackish-brown. Head elliptical, nearly $1\frac{1}{2}$ times as wide as long, the [interocular] face about twice as broad as the eyes and narrowing anteriorly, the rather broad orbital margins and the semi-circular, uniformly convex vertex [postvertex] smooth and polished, leaving a subtrapezoidal, opaque median area [mediovertex]. Inner edges of the polished orbital margins [inner orbits] more or less hairy. Clypeus [frons] $\frac{1}{10}$ as long as the front [mediovertex], usually rather shiny, divided into two sections by a deep, median, transverse sulcation, the apical section rather broad and anteriorly broadly and shallowly emarginate, so that its visible basal width along the dividing sulcation is fully one-half of the distance across the emargination between the lateral apices. Antennary processes brownish-black and bearing long ferruginous and black hairs. Palpi blackish, subequal to the clypeus [frons] in length, copiously clothed with short, pale hairs. Eyes shining blackish. Humeral processes short and heavy, their tips obtuse, in color a yellowish-testaceous distinctly paler than the coloration of the rest of the thorax above, bearing several short blackish hairs and one long black bristle. Mesonotum with a distinct, impressed, median longitudinal line and straight, deep, transverse, median sulci which are but slightly if at all interrupted medially, the whole having a distinct cruciate form. Mesonotum anteriorly with very few, long, pale ferruginous hairs. Scutellum posteriorly broadly rounded, its apical margin finely rimmed and thinly provided with short, pale hairs, a deep median longitudinal sulcus giving it a sub-bilobed appearance. Pleura opaque and grayish because of a thin pollinosity over the dark brown integument. Under side of head brown, the labium [basement membrane] whitish. Sternum flat, shining, dark brown, the anterior angles prominent and extending as short contrastingly black lobes between the anterior coxae. Legs dark brown, below finely pale-haired, above sparsely black-haired, the claws black. Tergum light brown, darkening laterally, the base and apical portion together with a medio-apical stain, blackish, venter light brown, the whole abdomen thinly short-haired, these varying in color from pale at the base to blackish toward the tip of the abdomen, tergum with two latero-apical tufts of long, black hairs. Wings whitish, the costal veins and basal part of the longitudinal veins dark brown, the costa only moderately thickened beyond the end of the 1st vein which joins the costa a little before the 1st crossvein [anterior cross-vein], the costal border of the marginal cell $1\frac{1}{2}$ times as long as the costal border of the 1st submarginal cell, the 1st basal cell over twice as long as the 2nd basal cell." Swenk also mentions a variety, from Lincoln (host unknown), "having the scutellum with the median longitudinal sulcus very weak, so that the scutellum is not at all sub-bilobed in appearance, and the vertex [postvertex] with a large, shallow anterior concavity (this is feebly marked in typical *albipennis*).'' I have seen Swenk's specimens at the University of Nebraska in 1940 and again in 1953. They are females and have the subcosta of the wing complete, ending in the costa, in both wings.

Original description of *O. ardeae* (translated from the French): "Length, 2 [French] lines [=4.5 mm.]. Shiny black. Face and palpi testaceous. Thorax with an impressed dorsal line. Legs brownish testaceous. Wings fuliginous." So far as could be traced, the type of *O. ardeae* is lost. The species was first recognized by Schiner (1853) in 3 flies taken from a European bittern, *Botaurus stellaris*, in Moravia (formerly in Austria, now a part of Czechoslovakia). In 1864, Schiner gave the following description, copied here (translated from the German), because it is more complete than Macquart's, although no structural characters are included: "Shiny black; thorax with a pale-brown, impressed

dorsal line [median notal suture]; abdomen brown, the sides reddish-yellow; [interocular] face blackish-brown, paler toward the antennae; antennae, palpi and legs sometimes pale, sometimes dark horn-brown; femora always palest at the base; claws pitch-black; wings blackish. 3 [Austrian] lines [= 6.5 mm.; evidently the total length to the tips of the wings folded over the abdomen].'' Following Schiner Macquart's trivial name *ardeae* has been used since 1864 for the common small *Lynchia* of Old World waders. It is, however, not possible to separate this from the New World parasite of waders, Say's *albipennis*, by any reliable structural peculiarity. Say's earlier name (1823) therefore supersedes that given by Macquart (1835).

Original description of *O. propinqua*: "Viridi-picea, capite anteo pallidior, pedibus fulvis, femoribus nigro subvittatis, tarsis piceis, alis fuscis. Body pitchy, smooth, shining; shoulders, front of the head and mouth paler; sides of the crown metallic green; chest more slightly metallic: tip of the abdomen beset with a few black bristles: legs tawny; thighs slightly streaked with black; feet pitchy; claws black; wings brown; wing-ribs and veins pitchy. Length of the body $1\frac{1}{2}$ line [= about 3.5 mm.]; of the wings 5 lines [= span of wings, about 11.5 mm.].'' Walker mentions only one specimen, now marked as type at the British Museum. This is a female which I studied in 1951 and was unable to separate from other specimens of *L. albipennis*. According to Dr. G. B. Fairchild (*in litt.*, 1953), the wing is 4.8 mm. long; the subcosta is incomplete in the right wing, complete or nearly so in the left, though weaker at the costa. A second specimen of the same species, also from Jamaica and probably dating from Walker's time, now stands with the type. Austen also had placed with it the male paratype of van der Wulp's *O. coriacea*, from Presidio, Mexico, which he had recognized correctly in 1903 as conspecific with *O. propinqua*.

Original description of *O. botauri*: "Statura paulo minor *O. ardeae*, et praecipue distincta, colore corporis sub-testaceo, non nigricante piceo; pedibus pallidis non fuscis: Abdomine toto sordide lutescente, basi tantum obscura; et alis albicantibus non infuscatis, venis rufescentibus non nigricantibus ec. Tamen longitudine venae tertiae, et praesentia transversae interioris, alisque notis, similis *ardeae*." Dr. B. Lanza informs me (*in litt.*, 1953) that the type, labelled as from Liguria, is now in Rondani's Collection at the Natural History Museum in Florence. Although it has not been studied critically, there can be little doubt that it is conspecific with *L. albipennis*.

Original description of *O. palustris* (translated from the Portuguese): "Length of body 5 mm.; of head and thorax combined 3 to $3\frac{1}{2}$ mm.; of wing 7 mm. [erroneous, as shown below]. General color chocolate, partly with metallic gloss. Wing with the bare area restricted to the axillary [= postaxillary] cell. Head very wide, the length much less than the width. Surface of palpi honey-yellow, covered densely with black hairs; process of clypeus short, forming an obtuse angle; ferruginous on the frons, turning black behind. Antennae: process shiny black and with hairs; apex and basal process honey-yellow, finely granulose; frontal triangle medially with a linear depression, its surface yellow, somewhat infuscated and very shiny; other margins of frons dark, with bronzy and greenish gloss; triangle of vertex [postvertex] truncate at the frons and on the whole rounded, with a small superficial depression in the middle of the anterior margin; lateral margins of frons [inner orbits] with a row of yellow ciliae and some larger bristles, two at the frons, one in the middle of each side, crossing each other over the occipital triangle, and another at the occipital margin; dull part of frons broad, but more elongate and narrower over the anterior half. Under side of head shiny infuscate-yellow; membrane below the proboscis the color of parchment. Mesonotum with a bronze-green gloss, some golden-yellow hairs and fine striae at the periphery, converging toward the center; humeral callosities ochraceous-gray; spiracles forming a white spot posteriorly; median notal suture almost linear, accompanied by two reddish lines, which are fainter anteriorly; transverse mesonotal suture deep, effaced over a small stretch medially; lateral areas of mesonotum,

before the scutellum, somewhat depressed and less shiny. Scutellum divided in the middle; the furrow little widened anteriorly, more so posteriorly; gloss as on mesonotum; hind margin with 2 rows of golden-yellow ciliae, one premarginal, rather indistinct, the other marginal, stronger. Humeral callosity with short, black spines; squamular process with longer spines; in addition, various dark bristles, distributed over outer area of thoracic dorsum. Abdomen chocolate color, with fine golden-yellow hairs and some postero-lateral dark bristles; some yellowish spots near anus and beneath. Legs chocolate color, turning olivaceous-gray over distal parts and beneath. Sternum glossy reddish-gray. Wings with yellowish ground-color, slightly infuscated by microscopic hairs [microtrichia]; heavier veins chestnut, the other yellowish; auxiliary vein [subcosta] variable, not always reaching costa; a golden-yellow ridge between bases of 4th and 5th veins; alula small; upper calypter well developed, lower calypter rudimentary." The length given for the wing (7 mm.) is clearly out of proportion with the other measurements. As the figures of Pl. 28 are all said to be enlarged $9\frac{1}{2}$ times, the true length of the wing must be about 5.4 mm., which agrees with the several cotypes of *palustris* I have examined. One of these was presented to the Museum of Comparative Zoology some years ago by the late Dr. Ad. Lutz; others were received for study more recently from the Instituto Oswaldo Cruz through the kindness of Dr. H. de Souza Lopes. The wings of these cotypes are from 5.3 to 6 mm. long. Before seeing them, I was misled by the erroneous wing length originally given and, in one of my early papers (1933*b*, p. 71), attempted to recognize *O. palustris* among the larger species of *Lynchia*. Consequently, I then referred to it an African fly of cormorants. The error was corrected later (1945*b*, p. 96), when it was stated that *palustris* was one of the small species of *Lynchia*, "very closely related to, or possibly even identical with, *Lynchia albipennis* (Say)." Further study of additional material from waders leaves no doubt that *palustris* is identical with *albipennis*, the only South American small *Lynchia* with only the postaxillary cell extensively or almost completely bare.⁴⁹

Original description of *O. botaurinorum*: "Very similar to *O. albipennis* Say, above redescribed, but distinctly larger, the length of the head and thorax measuring 3.25 mm., the width of the thorax at its widest part 2.5 mm., and the distance from the front of the head to the tip of the wing 8 mm. Color of head and thorax darker, more blackish, the color of the humeral processes not distinctly paler than that of the rest of the thorax above. Head less broad, $1\frac{1}{4}$ times as wide as long, the apical section of the clypeus [frons] comparatively narrow at base and rather deeply emarginate at apex, so that the visible basal width along the dividing sulcation is not more than $\frac{1}{3}$ of the distance across the emargination between the lateral apices. Antennary processes black and bearing much black hair. Face without obvious hair along orbital margins and mesonotum likewise not hairy. Wings faintly clouded. First vein joining the costa considerably before the 1st crossvein [anterior cross-vein]. Otherwise agreeing with the preceding description of *O. albipennis*. It is possible that this form is conspecific with *A. ardeae* Macquart, but after a careful comparison with the description I have decided to let it stand as distinct. Certainly the wings are not as dark as described for *ardeae*." I was able to study the holotype and 2 paratypes, all females, at the University of Nebraska in 1940 and again in 1953. The only structural difference I was able to detect

⁴⁹ The large Old World *Lynchia* of cormorants, which I called *L. palustris* in 1933, was later described as *Lynchia schoutedeni* J. Bequaert (1945*b*, p. 93). I now suspect that it will eventually be recognized as identical with *Lynchia massonnati* Falcoz (1926, p. 31), based on the fly from France erroneously referred to *L. americana* by Massonnat (1909, p. 304).

between these flies and those called *albipennis* by Swenk, was in the extent of the subcosta, a character, moreover, not mentioned by the author. The subcosta is incomplete in both wings in all 3 types of *botaurinorum*, stopping some distance from the costa. In the discussion of the affinities I pointed out that this character is unreliable for the separation of species among the small *Lynchia* of waders. The wing of the holotype of *botaurinorum* is 5.8 mm. long.

Original description of *O. scutellaris*: "Resembling *O. albipennis* Say, but differing from that species, as above described, in the following characters: Somewhat larger, the length about 5 mm., the head and thorax alone measuring 3 mm., the thorax being nearly 2.5 mm. wide at the widest part, and the distance from the front of the head to the tip of the wing measuring 7.5 mm.; head less broad, subcircular, the width only $1\frac{1}{3}$ times the length, the face very broad, fully $2\frac{1}{2}$ times as broad as the eye; elevated orbital margins opaque or slightly shiny along extreme outer edges only, their inner edges distinctly hairy; clypeus $\frac{2}{3}$ as long as front, the apical section shaped as in *O. botaurinorum* but with the base slightly wider, so that it is slightly more than $\frac{1}{3}$ ($\frac{2}{3}$) of the distance between the lateral apices; antennary processes blackish and bearing much black hair, the palpi slightly shorter than the clypeus; eyes dull plumbeous; each side of scutellum with a long black bristle; wings slightly darker, the 1st vein joining the costa considerably before the 1st crossvein; coloration of head and thorax brownish fuscous, the shiny vertex and basal portion of the median longitudinal line stained with reddish, the tips of the tubercles and the scutellum reddish yellow, the latter contrasting strongly with the much darker mesonotum. This species is even closer to *O. botaurinorum*, just described, than to *O. albipennis*, agreeing with the former in size, clypeal structure and venation, but easily separated by the more brownish general coloration, yellowish scutellum, hairy face and mesonotum, broader front, opaque orbital margins and dull-colored eyes." The ♀ holotype, seen at the University of Nebraska in 1940 and 1953, agrees with the types of *botaurinorum* in the incomplete subcosta in both wings and in all other structural characters. In particular, the inner orbits (Swenk's "orbital margins") are equally setulose ("hairy") in all these types, with setae in 2 or 3 irregular rows; but some of the setae may be broken and indicated only by their insertions. I could detect no appreciable difference in the width of the frons basally (Swenk's "clypeus").

Original description of *L. setosa*: "Male. Length on slide, 5.5 mm.; length of wing, 5 mm. A very dark species. Head rather small and rather short and broad, the clypeus [frons] deeply emarginate anteriorly, but the lateral arms only slightly exceeding the antennae; vertical triangle [postvertex] not emarginate or incised anteriorly; ventral side of the head with numerous setae. Thorax noticeably broad and laterally angulate; humeral angles (humeral callosities) short and very broad. Legs with a notable paucity of large setae and a notable abundance of extremely small setae, the surfaces being almost entirely covered with the latter. Wings with the venational type common to the genus but the subcosta not attaining the costa; entirely covered with setulae, excepting only a portion of the area behind the anal vein, this vein itself, and vein M_3+Cu [5th longitudinal]. Abdomen devoid of all but the usual basal and apical tergites; bearing numerous small setae which are not borne on tubercles, or at the most with such tubercles extremely inconspicuous. — Female. In all respects essentially identical with the male, the only dimorphism being in the position of the genital opening which is closer to the apex of the body, in the absence of the very minute claspers of the male, and the presence of a very small tergal plate just caudad of the basal tergite. — I somewhat suspect this species of being *L. nigrita* (Speiser), although the only clues to the identity of the latter, which was described from Manila without any indication of host, are to be found in the note as to its dark color and the statement that the humeral callosities are 'sehr auffallend stump, wenig spitzer als ein rechter Winkel.'" Before seeing the types, I had reached the conclusion, from the description and figures, that *L. setosa* was most probably the common, world-

wide, small *Lynchia* of wading birds. The discrepancies, such as the lack of median sclerite behind the basal laterotergites of the abdomen in the ♂, the nearly parallel-sided interocular face and the noticeably broadened and laterally prominent thorax, seem to be due either to contraction of the soft areas of the abdomen or to flattening by pressure of the cover-glass on the slide mount. A recent study (1953) of the holotype (♂) and allotype (♀), at Stanford University, has convinced me of the correctness of this view. I have also examined the additional specimens from the Philippines referred by Ferris later (1930) to his *setosa*. All are in my opinion conspecific with *L. albipennis*. Whether or not *Olfersia nigrita* Speiser (1905, Zeitschr. Syst. Hym. Dipt., 5, p. 358. — No sex; no host. Philippines: Manila. Type at Vienna Mus.) is the same species, as Ferris suggested, cannot be decided from Speiser's description.

Lynchia hirsuta Ferris

Figs. 51 and 66 A-G

Lynchia hirsuta Ferris, 1927, Canad. Entom., 59, p. 249, figs. 1 (♀; mislabeled *L. americana*, but corrected by Ferris, 1929) and 4A-D (California: Stanford University, ♀ holotype and ♂ allotype, on *Lophortyx c. californica*; Altadena, ♀ paratype on *Toxostoma r. redivivum*. All types in Museum of Stanford University, Palo Alto, California); 1929, *Op. cit.*, 61, p. 285. O'Roke, 1929, Science, (N.S.), 70, p. 432 (transmission of *Haemoproteus lophortyx*); 1930, Univ. California Publ. Zool., 36, pt. 1, p. 12, figs. A-B, after Ferris, 1927 (California: Mt. Hamilton; Mt. Diablo; on *Lophortyx c. californica*; puparium; vector of *Haemoproteus lophortyx*); 1932, California Fish Game, 18, p. 230, fig. 50 (California: Berkeley Hills between Berkeley and Orinda). Rawson, 1934, Scientific Monthly, 39, p. 504. Sumner, 1935, California Fish Game, 21, p. 244 (California: Sa. Cruz Mts., on *Lophortyx c. californica*). Herman and Glading, 1942, *Op. cit.*, 28, p. 150, fig. 45 in part (smaller of 2 flies). Benbrook, 1943, in Biester and Devries, Diseases of Poultry, 1st Ed., p. 615. Herman, 1944, JI. of Parasitology, 20, p. 114 (California: Orange Co., on *Lophortyx c. californica*); 1945, California Fish Game, 31, p. 20 (infestation with *Myialges* mites).⁵⁰ Benbrook, 1948, in Biester and Schwarte, Diseases of Poultry, 2nd Ed., p. 733. Herms, 1950, Medical Entomology, 4th Ed., p. 414. Tarshis, 1952, Bull. Brooklyn Ent. Soc., 47, pp. 69, 70, and 78 (on trapped *Lophortyx c. californica* in California); 1953, Summary of Dissertation, Berkeley, California, p. 1. Furman and Tarshis, 1953, JI. of Parasitology, 39, p. 70 (California: on *Lophortyx c. californica*; flies infested with *Myialges anchora*, from Bitterwater, Hunter Liggett Military Reservation and San Pablo Dam; flies infested with *Microlichus lophortyx*, from Bitterwater). Reichenow, 1953, in Doflein, Lehrbuch d. Protozoenkunde, 6th Ed., p. 894. Tarshis, 1954, Psyche, 61, p. 58 (technique); 1955, Experimental Parasitology, 4, No. 5, pp. 464-492, fig. 3 (experiments with *Haemoproteus lophortyx*).

Distribution and Specimens Examined. UNITED STATES. CALIFORNIA (recorded by Ferris, 1927; O'Roke, 1930, 1932; Sumner, 1935; Herman, 1944, 1945; Tarshis, 1952, 1953; Furman and Tarshis, 1953): [without precise locality, on *Lophortyx g. gambelii* in captivity (C.M. Herman, *in litt.*, 1945)]; Harbin Springs, Lake Co., on *Junco oreganus thurberi* (J. Maillard); Castle Hot Springs,

⁵⁰ Fig. 10B shows *Ornithoica vicina* (Walker), not *Lynchia hirsuta* as captioned.

Lake Co., on *Pipilo fuscus carolae* (J. Maillard); Chiles Ranch, Chiles Valley, Napa Co., on *Lophortyx c. californica*, June 8, 22 and 30, July 14, 15, 26 and 27, Aug. 18, and Nov. 4, 5, 6, 8 and 11 (I.B. Tarshis, C.M. Herman and A. Hightower); Mill Valley, Marin Co., on *Lophortyx californica brunnescens* (E.S. Ross); Mt. Diablo, Contra Costa Co., on *Lophortyx c. californica*, July 7 (E.C. O'Roke); San Pablo Dam, Orinda, Contra Costa Co., on *Lophortyx californica brunnescens*, June 21, Oct. 30, and Nov. 3 (I.B. Tarshis and A. Hightower); Lafayette, Contra Costa Co., on *Lophortyx californica brunnescens*, Nov. 7 (I.B. Tarshis); Concord, Contra Costa Co., on *Cyanocitta stelleri frontalis* (E.C. O'Roke); Sa. Cruz Mts., San Mateo Co., on *Lophortyx c. californica* (E.L. Sumner, Jr.); Oakland, Alameda Co., on *Lophortyx c. californica* (B. Cain); Stanford University, Palo Alto, Sa. Clara Co., ♀ holotype and ♂ allotype on *Lophortyx c. californica*, Oct. 21 and Dec. 14 (C.D. Duncan and E. Quayle); Watsonville, Sa. Cruz Co., on *Lophortyx californica brunnescens*, Sept. 9 (I.B. Tarshis and Hightower); Hastings Reservation near Jamesburg, Monterey Co., on *Lophortyx c. californica*, July 15, Sept. 11 and 13, and Nov. 13, *Toxostoma r. redivivum*, July 24, and 9 flies on 4 *Pipilo fuscus crissalis*, June 23, July 18 and 29, and Sept. 6 (J.M. Linsdale); Jolon, Hunter Liggett Military Reservation, Monterey Co., on *Lophortyx c. californica*, Sept. 16, 17, 18, 19, 20, 21, 22 and 23, Oct. 1, 3, 11, 13, 18, 19 and 22, Nov. 12, 14, 17 and 19, and Dec. 8 (I.B. Tarshis, *et al.*); Bitterwater, 15 miles S.E. of King City, San Benito Co., on *Lophortyx c. californica*, Aug. 6, 7, 8, 9, 10, 11, 12, 13, 23, 25, 27, 28, 29 and 30, Sept. 21, 22, 23, 25, 27, 28, and 29, and Nov. 24 (I.B. Tarshis, *et al.*); Shandon, San Luis Obispo Co., on *Lophortyx c. californica*, Aug. 7, 13, 14, 16 and 24, and Sept. 2 (I.B. Tarshis and I. McMillan); Cedar Canyon, Cook Spring, Kern Co., on *Lophortyx c. californica*, Sept. 21, 22 and 23, and Oct. 17, 18, 19, 20 and 21 (I.B. Tarshis, *et al.*); Pomona, Los Angeles Co., on *Lophortyx c. californica*, June 1 (G. Augustson); Altadena, Los Angeles Co., ♂ paratype on *Toxostoma r. redivivum*, Sept. 20 (J.E. Law); Modjeska, Orange Co., on 3 *Lophortyx c. californica*, Aug. 14 (C.M. Herman); Hemet, Riverside Co., on *Oreortyx p. picta*, July 29 and 31, and Oct. 1 (Calif. Fish Game); Calipatria, Imperial Co., 1 ♀ on *Pipilo aberti dumeticolus*, July 28 (J.N. Belkin).—IDAHO: Boise, Ada Co., on *Dendragapus obscurus richardsoni* (F.C. Bishopp).—NEVADA: South Fork of Cherry Creek, Clan Alpine Mts., Churchill Co., Sept. 21, on *Centrocercus urophasianus* (H.T. Dalmat); vicinity of Reno, on *Centrocercus urophasianus* (H.E. Gallaway).—UTAH: Dove Creek, Box Elder Co., 8000 ft. (D.M. Rees).

L. hirsuta is exceptional among American hippoboscids for its very restricted distribution, as it is known at present only from about 113° W. to the Pacific Coast, in California, Idaho, Nevada and Utah. In California it ranges from Lake Co. (39° N.), to Imperial Co. (close to 33° N., the southmost known occurrence). It extends somewhat farther north in Idaho (to 43° 30' N., the northmost record), Nevada (to 39° 30' N.) and Utah (to close to 42° N.).

Known Hosts of *L. hirsuta* (verified individual records in parentheses). Galliformes (94): *Centrocercus urophasianus* (2); *Dendragapus obscurus richardsoni* (1); *Lophortyx c. californica* (82); *L. californica brunnescens* (6);⁵¹ *Oreortyx p. picta* (3). Passeriformes (10): *Cyanocitta stelleri frontalis* (1); *Junco oreganus thurberi* (1); *Pipilo aberti dumeticolus* (1); *P. fuscus carolae* (1); *P. fuscus crissalis* (4); *Toxostoma r. redivivum* (2).—*Lophortyx g. gambelii* is not included in the list, because the only record is from a bird in captivity.

Bionomics. I discussed in Part I the host as an enemy of the fly (p. 130), the transmission of *Haemoproteus lophortyx* (pp. 138 and 358–360), infestation with mites (p. 158), the sex ratio (p. 179), larviposition (p. 194), the incubation period of the puparia (p. 199), mixed parasitism of the host with *Stilbometopa impressa* (p. 224), and the abundance of the fly on the host (p. 232). Dr. I.B. Tarshis has made many additional observations on these and other topics, publication of which is now in progress.

L. hirsuta is a specific, oligoxenous parasite of certain gallinaceous game birds, particularly California quail (*Lophortyx californica*), but also dusky grouse (*Dendragapus obscurus*), sage hen (*Centrocercus urophasianus*) and mountain quail (*Oreortyx picta*), all of which are regular breeding hosts. There is as yet no evidence that it lives in nature on Gambel's quail (*Lophortyx gambelii*). The few records (10 in all) from passerine birds are obviously due to accidental straying in nature, which should be expected in this case rather frequently in view of the abundance of the fly on quail in many localities. It is very common on at least one of its regular breeding hosts, particularly during summer and fall. The earliest date of capture on record is June 8 and the latest December 14.

⁵¹ In the case of *Lophortyx californica*, the number of individual records here given is the total of the days on which flies were collected in different localities. Actually this number is only a small fraction of the number of birds found infested with the fly, as specimens were usually collected the same day from several quail. *L. c. vallicola* is here regarded as a synonym of *L. c. californica*.

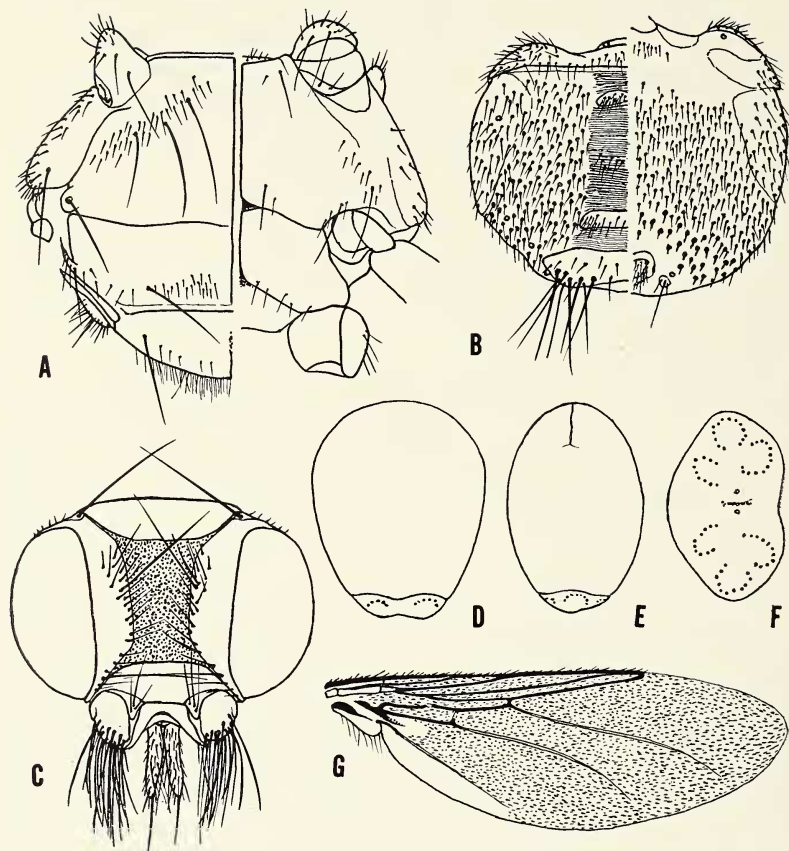


Fig. 66. *Lynchia hirsuta* Ferris. A-C, ♀, Bitterwater, Calif., on *Lophortyx c. californica*: A, thorax dorsally and ventrally; B, abdomen dorsally and ventrally; C, head. D-F, puparium bred on *Lophortyx c. californica* by Dr. I. B. Tarshis, from above (D), in side view (E) and respiratory lobes (F); G, wing, ♂, Hastings Reservation, Calif., on *Lophortyx c. californica*.

Sumner (1935, p. 244) found in the Sa. Cruz Mts., California, that between July 29 and October 7, 1933, at least one out of every five California quail harbored one or more *Lynchia*. He added that "at no time other than the season mentioned were hippoboscoid flies found on quail, although the banding program, which involved handling large numbers of birds, would have revealed them had they been present." O'Roke (1930, p. 15) took flies in every month from June to October, the first being captured June 8. He stated, however, that hunters reported seeing flies on quail also in December and January. Dr. Tarshis and his associates, who investigated the occurrence of *L. hirsuta* on quail over a large area in California, found it only from June 8 to December 8. In the Chiles Valley area of California, where collection records are available on an annual basis, the fly was completely absent from January to May (Furman and Tarshis, 1953, p. 70).

Dr. Tarshis reached the conclusion that, in northern California at any rate, the adult fly disappears from quail early in December and that *L. hirsuta* most probably spends the winter in the pupal stage; but no puparia have as yet been found in nature. O'Roke (1930, p. 15) observed three larvipositions by females removed from quail and kept in vials; only one of these produced a fly, after an incubation period of 31 days. He also saw a pair in copulation on October 5. The puparium is as yet undescribed. My figures (Figs. 66D-F) and description are based on specimens raised from flies kept on quail in captivity by Dr. I.B. Tarshis. The mature puparium is much smaller than that of *L. americana*, about 2.2 mm. long, 1.8 mm. in greatest width and 1.4 mm. thick. It is also distinctively oval, not elliptical in outline, being narrowed behind toward the respiratory lobes, and equally convex dorsally and ventrally. Most of the surface is shagreened with the usual microscopic alutaceous sculpture. The cap bearing the respiratory lobes is barely raised, irregularly elliptical, not hexagonal in outline, the ventral margin only with a shallow inward curve. It is divided into two lateral areas by a shallow apical depression; on each half the minute, slightly raised respiratory pores are placed in three curved, bow-like groups, similar to those of *L. americana*, but with fewer pores in each group. The surface of the cap is almost impunctate, with only a few, minute, nearly imperceptible punctures, too small to be shown in Fig. 66F.

Furman and Tarshis (1953) recently published a detailed study of the mites infesting *L. hirsuta*. They found that in California of 900 flies taken from trapped quail (*Lophortyx c. californica*), 20,

or 2.2 per cent, were parasitized with mites, 18 harboring *Myialges anchora* Sergent and Trouessart and 2 carrying a new species, *Microlichus lophortyx* Furman and Tarshis (1953, p. 72, figs. 1-4). They also reached the conclusion that *Myialges* and *Microlichus* belong in the family Epidermoptidae (see Part I, p. 148). They retain the two genera, however, separating them in the female by the hysterosomal plate of the dorsum (present in *Microlichus*, absent in *Myialges*) and by the claw of tarsus II (present in *Microlichus*, absent in *Myialges*).

Affinities. *L. hirsuta* is easily recognized by the characters given in the key, particularly the peculiar stiff bristles in the setose patches of the prescutum, the bare postaxillary cell, and the two small median sclerites in the dorsal striated area of the abdomen. It is the only American species of *Lynchia* with two such sclerites, one placed immediately behind the fused basal laterotergites, the other slightly basad of the large, bristly apical tergite.

There is little variation in the shape of the postvertex, which is short and very wide, with a long straight anterior margin, not emarginate nor depressed apically, and the surface without pit.

The venation varies little. The subcosta is normally complete, ending in the costa (Fig. 66*G*). This is the case for both wings in 139 (75 ♀ and 64 ♂) of 142 flies collected at random in California on *Lophortyx californica*. In the remaining 3 ♀ (from Hemet and Bitterwater), the subcosta is complete in one wing and incomplete in the other. In addition, the subcosta was complete in 1 ♀ and 1 ♂ from *Pipilo fuscus* (California), 1 ♂ from *Dendragapus obscurus* (Idaho) and 1 ♂ from *Centrocerus urophasianus* (Nevada). Usually the subcosta ends in the costa opposite the anterior basal cross-vein or nearly so (Fig. 66*G*); occasionally it ends decidedly apicad of this cross-vein. The remaining stump of the 6th longitudinal vein is short, but distinct.

The sexual differences are slight. The relative width of the interocular face is about the same in both sexes. The two median dorsal sclerites of the abdomen are present in both sexes, but somewhat larger in the ♂ than in the ♀, being particularly wider (transversely). Ventrally the apical area of the abdomen of the ♀ bears very short setae on heavy tubercles, contrasting with the setae of the remainder of the venter; in the ♂ the insertion of the setae in this area is much less swollen and the setae are about as long as elsewhere. In addition, the ♀ has a soft setigerous knob between the ano-genital openings and the 7th abdominal spiracle, similar to that of *L. americana*, but much smaller and with fewer setae. The ♂

lacks this setigerous ventral knob. The setigerous lobe at each side of the genital atrium of the ♂ is shorter and narrower than in some other species of *Lynchia* of comparable size.

Original description of *L. hirsuta*: “*Female*. Length on slide 5 mm., length of wing 5 mm. Clypeus [frons] emarginate, the lateral processes very slightly exceeding the antennae. Ocellar triangle rather faintly defined, without median incision or emargination and with a small, median area of heavier chitization. Orbits broad, with two large and numerous fine setae. Ventral side of the head with three conspicuously long setae near the base of the antenna. Thorax with the humeral calli very short and broad, but acutely pointed. In addition to the fixed setae, which are to be found in all the species of the genus, there are three long setae on each half of the prescutum and a pair of long prescutellars. Scutellum with a distinct median sulcus, which divides it into two lobes. Pleurotergite of the postscutellum distinctly swollen and bearing a cluster of setae which are concealed above the posterior coxa. Sternum with an undivided lobe between the anterior coxae. Legs with no specially distinctive characters, but rather noticeably sparsely haired. Wings entirely beset with setulae except for the area behind the anal vein. Subcosta complete, attaining the costa. Abdomen with two small tergal plates in addition to the usual basal and apical plates. The anterior lateral region shows a weakly defined plate on each side, this sparsely beset with setae, and the median dorsal area of transverse striations is almost devoid of setae. The membranous areas are beset with small slender setae which are borne upon slight tubercles and in the apical region on the ventral side there are numerous small, stout setae of which the supporting tubercles are noticeably larger.—*Male* closely resembling the ♀ but slightly smaller, length 4.5 mm., length of wing 4.5 mm. The external genitalia are represented merely by a pair of small flaps.” Through the courtesy of Prof. G.F. Ferris, I was recently (1953) able to study the three types at Stanford University.

Lynchia holoptera (Lutz, Neiva and da Costa Lima)

Figs. 67A–C, 68 and 69

Olfersia holoptera Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 184 (no sex. Brazil: State of Rio de Janeiro, on *Rhynchotus r. rufescens* and *Aramides saraeura*. Types at Inst. Osw. Cruz, Rio de Janeiro).

Lynchia holoptera J. Bequaert, 1943, Jl. of Parasitology, 29, p. 134. MacArthur, 1948, Bull. Publ. Mus. Milwaukee, 8, pt. 4, pp. 410 and 425, figs. 252–253 (Wisconsin: Madison, Dane Co., on *Rallus l. limicola*).

Distribution and Specimens Examined. UNITED STATES. MASSACHUSETTS: North Eastham, Barnstable Co., ♀ on *Rallus l. limicola* July 3 (F.C. Bishopp). — OHIO: South Bass I., Lake Erie, ♀ on *Rallus l. limicola* (W. Britt). — PENNSYLVANIA: Linesville, Crawford Co., ♀ on a rail, May 15 (R.H. Fricke). — SOUTH CAROLINA: Mount Pleasant, Charleston Co., ♀ on *Coturnicops noveboracensis*, Nov. 8 (A.T. Wayne). — WISCONSIN (recorded by MacArthur, 1948): Madison, Dane Co., ♀ on *Rallus l. limicola*, June 13 (J. Beer).

BRAZIL (recorded by Lutz, Neiva and da Costa Lima, 1915).

L. holoptera, known at present only from some of the eastern

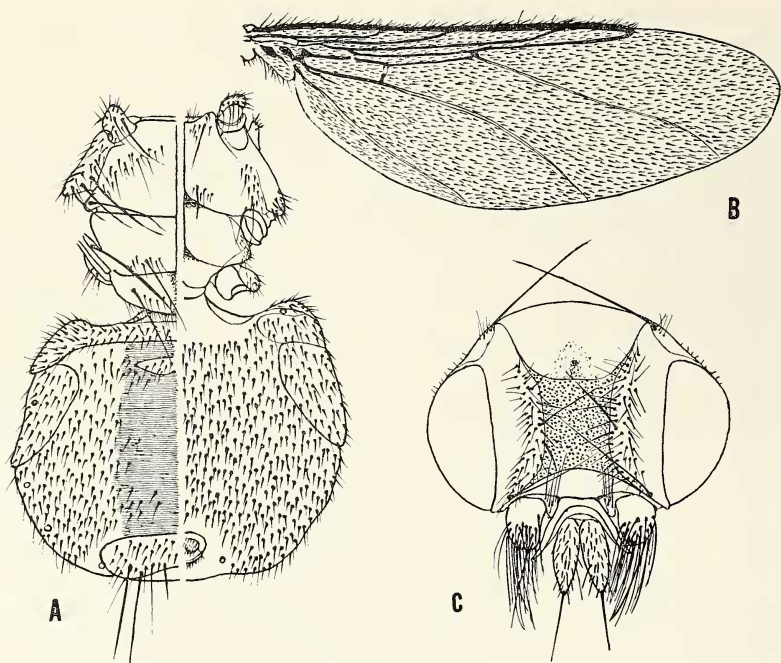


Fig. 67. *Lynchia holoptera* (Lutz, Neiva and da Costa Lima), ♀, North Eastham, Mass., on *Rallus l. limicola*: **A**, thorax and abdomen dorsally and ventrally; **B**, wing; **C**, head.

and central United States and from the State of Rio de Janeiro in Brazil, no doubt is widely distributed in the New World. Rails, its main hosts, are difficult to collect and their ectoparasites seldom obtained.

Known Hosts of *L. holoptera*. Tinamiformes: *Rhynchotus r. rufescens*. Gruiformes (4 and 1 unidentified rail): *Aramides sara-cura*; *Coturnicops noveboracensis* (1); *Rallus l. limicola* (3).

Bionomics. Of the 7 host records known to date, 6 are from rails of three species, so that the Rallidae may safely be regarded as the true breeding hosts. The single record from a tinamou may have been due to straying or perhaps to *post mortem* contamination; although tinamous and rails are ground birds of somewhat similar habits, so that they could possibly harbor the same louse-fly. The puparium is unknown.

Affinities. *L. holoptera* is easily recognized by the characters given in the key and by the figures. The ♂ is as yet unknown. The

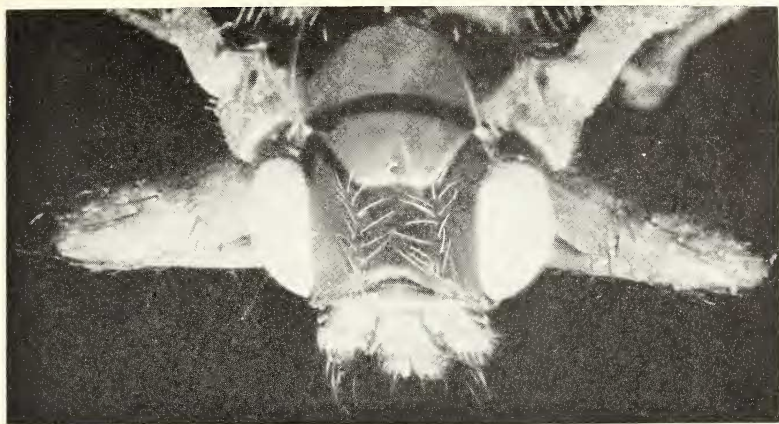


Fig. 68. *Lynchia holoptera* (Lutz, Neiva and da Costa Lima), head, ♀, Madison, Wise., on *Rallus l. limicola*. Photograph by Mr. K. MacArthur (1948, fig. 253).

material seen is too scant for a study of variation. In the few flies available the subcosta is complete in both wings (Figs. 67*B* and 69), as noted in the original description; it usually ends about opposite the anterior basal cross-vein or slightly basad. The 2nd basal cell is relatively long and narrow, about half the length of the 1st basal cell or slightly shorter. The anterior cross-vein is very short and thick. The microtrichia cover practically the entire membrane, except for a very narrow bare strip along the lower (outer) margin of the postaxillary cell. The wing is 4.6 to 5 mm. long. The postvertex is unusually long, only about twice as wide as long; its anterior half is broadly depressed medially, with a weak median pit a short distance from the margin. There is usually only 1 vertical bristle; but the ♀ from North Eastham, N.H., has 2 bristles on the right and 1 bristle on the left outside the corners of the postvertex. The abdomen has one median sclerite differentiated in the striolate dorsal area close behind the fused basal laterotergites (sometimes partly hidden by contraction under their hind edge); the 3rd laterotergite (bearing the 3rd abdominal spiracle) is better differentiated and more sclerotized, both dorsally and ventrally, than in most other *Lynchia*. There is no raised setigerous knob ventrally between the 7th abdominal spiracle and the ano-genital openings. The fly is more setose than usual, particularly on the legs, the femora and tibiae bearing, in addition to fairly numerous long bristles, many short setae, though not as many as in *L. albipennis*.

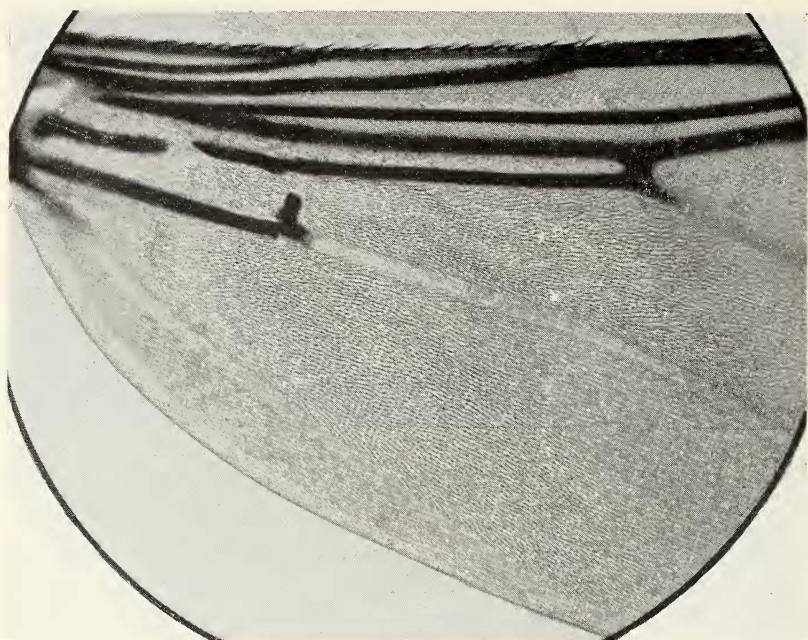


Fig. 69. *Lynchia holoptera* (Lutz, Neiva and da Costa Lima), basal area of wing, ♀, Madison, Wisc., on *Rallus l. limicola*. Photograph by Mr. K. MacArthur (1948, fig. 252).

Original description of *O. holoptera* (translated from the Portuguese): "Length 5 mm.; of wing 5 mm. General color chocolate; wings without bare area. Palpi ochraceous, covered with pruinosity and with blackish hairs. Antennae chestnut, the terminal portion with yellowish-white pruinosity and black hairs; basal process with yellowish pruinosity and bristles; clypeal process forming a slightly acute, almost right angle; its anterior face with yellowish-white pruinosity and its upper face shiny pale-chestnut; ocular margins [inner orbits] broad, dark-chestnut, shiny with a large dull depression over the median third of the inner margin; vertical triangle [postvertex] rounded, pale-chestnut, but infuscated medially; occipital margin convex behind, the anterior margin [of postvertex] with a small submarginal pit within a rather large median depression; middle part of frons [interocular face] black, finely striate, somewhat shiny, the bristles as in *O. palustris* [*Lynchia albipennis* Say]; space behind the eyes dull and whitish; under side of head ochraceous. Mesonotum black, with a bronzy gloss and some golden-yellow hairs; humeral callosities large, the color of tortoise, with a white spiracular spot; adjoining areas ochraceous-gray; posterior margin, from the base of the wings on, without gloss, widened before the scutellum into halfmoon-shaped lateral spots with the surface ashy and granulose, the median area between these spots shiny; in the middle of the spots one dark bristle and 5 other larger bristles on each side of the dorsal margin of the thorax; median notal suture narrow but deep behind the transverse suture, margined with reddish anteriorly; transverse mesonotal suture deep, effaced near the middle. Scutellum halfmoon-shaped, with rather large median, dull furrow, the remainder as on the

mesonotum, only the anterior margin yellowish and the ciliae darker. Abdomen gray, more or less infusate, with numerous black ciliae and on the posterolateral areas with larger bristles. Legs ochraceous-gray, as is also the thorax beneath; the surface finely granulose and shiny. Wings rather pale, but without bare part; veins chestnut or infusate; auxiliary vein [subcosta] ending in costa a little before inner [anterior basal] cross-vein." I have not seen the types.

Lynchia plaumanni J. Bequaert

Figs. 70A-H

Lynchia plaumanni J. Bequaert, 1943, Jl. of Parasitology, 29, p. 132, figs. 1A-E (♀ ♂. Brazil: Nova Teutonia near Ita, 27° 11' S., 52° 23' W., State of Sa. Catharina, ♀ holotype, ♂ allotype, and ♀ ♂ paratypes on *Odontophorus c. capueira*; ♀ paratypes on *Crypturellus o. obsoletus* and *Chamaeza c. campanisona* ["*Turdus brevicauda*"]. British Guiana: Paruni River, ♀ paratype on *Crax nigra*. Bolivia: Sa. Elena, Huachi, Río Beni, ♂ paratype. Holotype and allotype at Mus.Comp.Zool., Cambridge, Mass.; paratypes at Deutsch.Entom.Inst., Berlin-Dahlem, U.S.Nat.Mus. and Brit.Mus.).

Ornithophila sp. Aldrich, 1923, Insector Insectiae Menstruus, 11, p. 78 (Bolivia: Sa. Elena).

Distribution and Specimens Examined. MEXICO: Laguna Ocotul, State of Chiapas, ♀ on *Ortalis v. vetula* and ♀ caught flying (R.A. Paynter, Jr.).

BRITISH GUIANA: Paruni River, ♀ paratype on *Crax nigra* (Brit. Mus.).

BRAZIL: Nova Teutonia near Itá, State of Sa. Catharina, ♀ holotype, ♂ allotype, and ♀♂ paratypes on *Odontophorus c. capueira*, and ♀ paratypes on *Crypturellus o. obsoletus* and *Chamaeza c. campanisona* (F. Plaumann. — Mus.Comp.Zool., No. 29433; Deutsch. Entom.Inst.).

BOLIVIA (recorded by Aldrich, 1923, as *Ornithophila* sp.): Sa. Elena, Huachi, Río Beni, ♂ paratype (W.M. Mann. — U.S.Nat. Mus.).

Known Hosts of *L. plaumanni*. Tinamiformes (1): *Crypturellus o. obsoletus* (1). Galliformes (3): *Crax nigra* (1); *Odontophorus c. capueira* (1); *Ortalis v. vetula* (1). Passeriformes (1): *Chamaeza c. campanisona* (1).

Bionomics. Nothing definite can be said at present about the true breeding hosts of *L. plaumanni*, the known host records being too few. Other details of the life history are unknown.

Revised Description. *Female.* Head (Fig. 70C) in front view about $1\frac{1}{6}$ times as wide across eyes as high from occipital margin to tips of apical arms of frons. Interocular face at its narrowest about $1\frac{2}{3}$ times as wide as an eye, scarcely longer along inner orbit than its greatest width at postvertex, the sides converging toward

lower third. Inner orbits moderately wide, about $\frac{1}{3}$ of width of mediovertex at its narrowest; inner orbital bristles few: a lower group of 4 (3 very long) near lunula and a row of 3 to 5 (1 very long) at about mid-height of face; one long vertical bristle on each side. Postvertex wider than long, the nearly straight or slightly wavy anterior margin longer than the sides, with one or more rudimentary ocelli or with pits taking their place (Figs. 70C and E-F): some flies have only 3 pits without ocelli, either partly connected or fused into a single horseshoe-shaped depression; in others the pits show rudimentary ocelli, rarely in the anterior pit, more often in the other 2; these ocelli are usually very small and flat, but in one fly they are well defined and convex in all 3 pits; it is doubtful nevertheless that the ocelli are ever functional. Frons: lunula separated from the interantennal area by a complete transverse suture, with or without shallow median depression; basal, undivided portion of interantennal area narrower than its distance from inner eye margin; apical emargination very deep, moderately wide, with very long, narrow prong-like terminal arms, extending beyond tips of antennae. Antenna short: 1st segment separated by a complete suture from lunula, bearing 2 or 3 setae, one long; 2nd segment about twice as long as 1st along inner margin, rounded truncate at apex, moderately setose over apical dorsal half, with 5 or 6 long, recurved bristles. Palpi moderately long, nearly half the height of head. Thorax (Fig. 70A): anterior dorsal margin nearly straight in the middle; humeral callosities slightly longer than wide, moderately prominent, bluntly rounded at apex, with one long bristle and many shorter setae. Mesonotum on each side with 2 transverse patches of short setae, one behind the humeral callosity, the other before the scutellum; a longer bristle in the prescutellar patch; a long notopleural and a long postalar bristle on each side; dorsal portion of mesopleuron (anepisternum) with scattered short setae and one long bristle some distance from apex. Scutellum semi-elliptical; hind margin evenly convex, lower edge fringed with soft setulae; a pre-apical row of fine short setae; one long outer discoseutellar bristle on each side. Pleurotergite with a few short, stiff setae. No metasternal spurs near hind coxae. Legs: femora and tibiae with several strong bristles and sparse short setae; 4th tarsal segment of fore legs normal. Wing (Fig. 70D) short, relatively wide; microtrichia covering most of membrane, except for a small posterior bare area in basal $\frac{1}{2}$ to $\frac{3}{4}$ of combined anal, 3rd posterior and axillary cells and nearly entirely bare postaxillary cell; costa moderately swollen beyond tip of 1st longitudinal vein; 2nd basal cell slightly

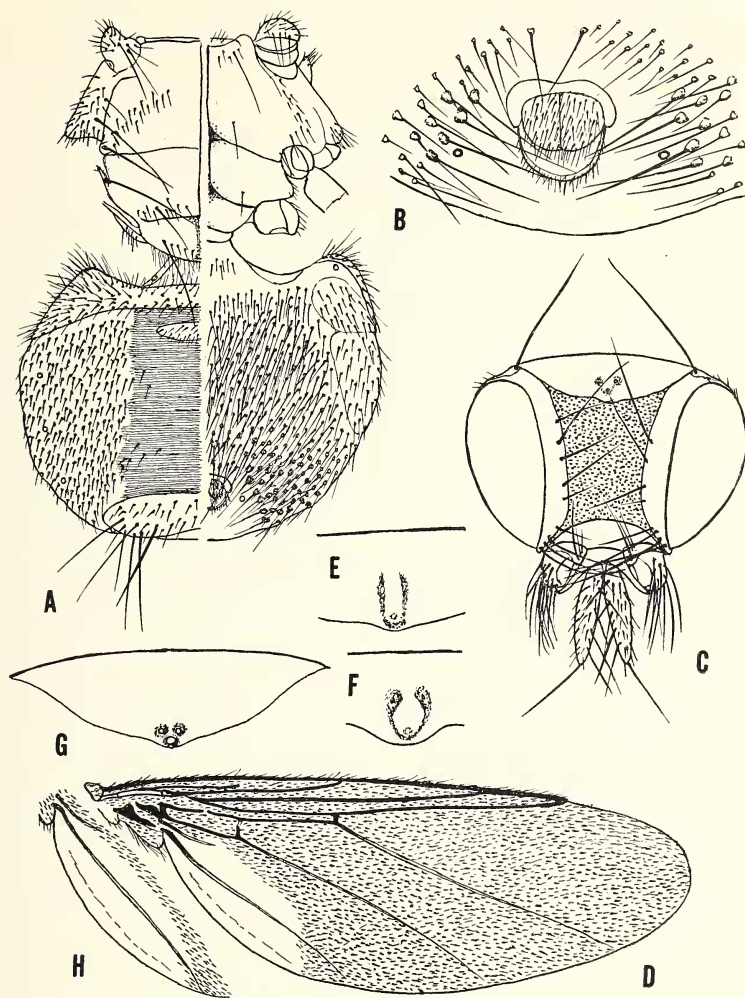


Fig. 70. *Lynchia plaumanni* J. Bequaert. **A–D**, ♀ holotype, Nova Teutonia, Brazil, on *Odontophorus c. capucira*; **A**, thorax and abdomen dorsally and ventrally; **B**, ventral anal area of abdomen; **C**, head; **D**, wing; **E** and **F**, ocellar area of 2 ♀ paratypes, Nova Teutonia, on *Chamaeza c. campanisona*; **G**, postvertex with rudimentary ocelli, ♂ allotype, Nova Teutonia, on *Odontophorus c. capucira*; **H**, axillary vein and postaxillary cell, ♂ allotype, same data.

less than half as long as 1st; anterior basal cross-vein nearly vertical; subcosta incomplete, not reaching costa (in all 9 flies examined), usually stopping in the membrane nearly opposite or basad of anterior basal cross-vein; stump of 6th longitudinal vein distinct, short. Abdomen (Fig. 70A-B) dorsally: a broad, short, transversely lozenge-shaped basal sclerite (fused 1st and 2nd laterotergites), bearing short, stiff setae at the sides and softer ones in the middle; large preanal tergite transverse, reniform, with a few short setae and an apical group of 7 or 8 long, stiff bristles at each side; middle of dorsum extensively dull, microscopically cross-striate, almost bare, with a small, smooth, median tergite behind and close to the fused basal laterotergites; sides of dorsum soft, uniformly and fairly densely covered with short setae; ventrally, 2 broad areas more or less defined at each side over basal half, sometimes partly sclerotized, the hindmost with an evenly, broadly rounded hind margin; venter fairly uniformly and densely setulose, the setae longer than usual, arising on the postero-lateral areas from strong, conical tubercles (Fig. 70B); no setulose raised knob between the 7th abdominal spiracle and the ano-genital openings ventrally.

Male. Similar to the ♀, even in the relative width of the interocular face and the sclerites of the abdomen; preanal dorsal sclerite of the same shape; but sides of basal laterotergites strongly produced behind as triangular lobes. Setigerous lobes at sides of genital atrium small. In the paratype the postvertex has 3 distinct ocellar pits (Fig. 70G), the anterior one bearing a large, flattened ocellus, the 2 posterior ones each with a very small, rudimentary ocellus.

Length (of both sexes) from tips of apical arms of frons to hind margin of scutellum, 2.7 mm.; of wing, 5.5 to 6.2 mm. long (6 mm. in ♀ holotype, 5.5 mm. in ♂ allotype); width of wing, 2 to 2.2 mm.; total length of dry holotype, slightly over 4 mm.

Affinities. *L. plaumanni* differs from most of its congeners in the presence of distinct ocellar pits or of rudimentary ocelli, traced in all known specimens, but varying as described above. In every other respect, however, it is a true *Lynchia*, so that I do not attach undue importance to this feature, although it appears to be a valid specific character. Moreover, as noted in the generic discussion, distinct ocellar pits or vestigial ocelli are present in a few other members of the genus, in some cases even more marked. The best known of these ocelligerous species is *Lynchia maquilingensis* Ferris (1924a, p. 392), of the Malay Archipelago. A study of the holotype at the U.S.Nat.Mus. and of the description and original figures shows that *maquilingensis* differs from *plaumanni* in several characters,

particularly in the extent of the microtrichia of the wing, which cover most of the membrane, leaving only a very narrow postero-marginal bare strip in the postaxillary cell (see Ferris, 1924a, p. 594, fig. 2a).

Original description of *L. plaumanni*: “*Female*. Head seen in front about $1\frac{1}{2}$ times as wide as high; frons at its narrowest about $1\frac{3}{5}$ times as wide as eye, measured along inner orbits scarcely longer than its greatest width at vertex, with sides markedly convergent toward lower third; inner orbits (parafrontalia) moderately wide, about $\frac{1}{3}$ of width of mediovertex (frontalia) at its narrowest; frontal bristles few: a lower group of 4 (3 very long) on gena and median row of 3 to 5 (1 very long) near edge of mediovertex; 1 very long vertical bristle; postvertex (vertical triangle) much wider than long, the nearly straight or slightly wavy anterior margin longer than the sides, with one or more rudimentary ocelli or depressions taking their place, as described below; fronto-clypeus broadly and rather shallowly emarginate medially, the antero-lateral angles moderately produced. Palpi moderately long, nearly half height of head. Thorax of usual shape; anterior margin nearly straight in the middle; humeral lobes slightly longer than wide, moderately prominent, bluntly rounded at apex, with 1 very long bristle and many shorter setae. Mesonotum on each side with 2 transverse patches of short setae, behind humeral lobe and before scutellum; a longer seta in prescutellar patch; a very long prealar and a similar postalar bristle on each side; dorsal portion of mesopleura (notopleura) with scattered short setae and 1 very long bristle near posterior corner. Scutellum semi-elliptical, hind margin evenly convex, fringed at edge with soft hairs and before this with a row of fine short bristles; 1 long scutellar bristle in each corner; metepimeron with a few, short setae. Legs without distinctive features; 4th tarsal segment of fore legs normal. Wing rather short and broad; microtrichia covering the membrane except for small basal area in anal cell (Cu + 1st An) and most of axillary cell (2nd An); costa moderately swollen beyond tip of 1st longitudinal vein; 1st basal cell (R) very long, narrow, parallel-sided; 2nd basal cell (M) slightly less than half length of 1st, closed by nearly vertical anterior basal cross-vein (M_2); subcosta (Sc) incomplete, not reaching costa; costa and basicosta densely setulose; all other veins bare. Abdomen with usual broad, short, transversely lozenge-shaped basal, sclerotized tergite, bearing numerous short, stiff setae on sides and soft hairs in middle; preanal (dorsal) sclerite transverse, large, reniform, bearing few short setae and in each apical corner 7 or 8 very long, stiff bristles; remainder of dorsum forming one sclerotized area, without differentiated tergites, dull, microscopically cross-striate, almost without pilosity; sides and venter soft, uniformly and fairly densely covered with short setae; ventrally, 2 broad sclerites more or less defined on each side over basal half, hind margin of 2nd evenly and broadly rounded off. — *Male*. Extremely similar to ♀, even in width of frons and structure of abdomen; preanal sclerite has same shape; but basal sclerotized tergite is produced at sides into triangular lobes. — Length (of both sexes) from tip of fronto-clypeus to apex of scutellum, 2.7 mm.; of wing, 5.5 mm.; width of wing, 2mm. (total length of dry specimen, slightly over 4 mm.). — An unusual feature of *L. plaumanni* is the presence of either rudimentary ocelli or ocellar pits, which could be traced in all 9 specimens. Their development varies. There may be only 3 pits in which no true ocelli can be seen, the pits being often more or less connected or sometimes forming one horseshoe-shaped depression. The anterior ocellus can rarely be detected, but the 2 posterior ocelli are often outlined, though small and flat.” This description has only a historical interest. The revised account, given above, should be used for a study of the species.

Microlynchia Lutz, Neiva and da Costa Lima, 1915

Microlynchia Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, pp. 177 and 185 (monotypic for *Lynchia pusilla* Speiser, 1902).

Generic Characters. Fully-winged parasites of birds, of small size (wing 3.5 to 6.5 mm. long), agreeing with *Lynchia*, except as noted here. Integument of head and thorax not metallic-greenish, sometimes with whitish, enamel-like areas; haemolymph without dull-greenish pigment. Vestigial ocelli more or less developed, minute, variable in size and shape even in the same species, occasionally lacking, possibly never functional. Lunula and interantennal portion of frons either separated by a superficial suture or completely fused; undivided base of interantennal area ending in two flaring apical arms varying in length. Antenna short: 1st segment setulose, either completely or partly separated by a superficial suture from the lunula, or fused with it; 2nd segment and arista as in *Lynchia* and *Pseudolynchia*. Dorsum of thorax as in most small species of *Lynchia* (such as *L. albipennis*); notopleuron fused with prescutum, but the limit between them sometimes faintly indicated by a depression, its hind corner well set off as a short lobe bearing a single, notopleural bristle. Transverse mesonotal suture continuous, deep and wide. Scutellum relatively longer than in most *Lynchia*, more transversely elliptical, the deep scutoscutellar suture evenly and slightly arched forward, the hind margin nearly straight, the slanting sides with evenly rounded hind angles, lacking the setigerous digitations of *Pseudolynchia*; usually one long disco-scutellar bristle in each corner (exceptionally 2 or 3 bristles); other preapical setae few and soft; thick, obtuse hind margin with a lower fringe of soft setulae; surface smooth, without median rugulose depression or line. Metathoracic pleurotergite more prominent than in *Lynchia* and *Pseudolynchia*, the apical (upper) part set off as a broad, blunt, setigerous knob or cone. Sternum: prosternum forming 2 broad, raised lobes between fore coxae, similar to those of *Pseudolynchia*, but lower, the notch between them being shallower; meta-basisternum more prominent laterally than in most *Lynchia*, the outer margin a broad, rounded lobe, but without the metasternal spur which overlaps the hind coxa in *Pseudolynchia* and a few species of *Lynchia*; basisternum and furcasternum of metathorax separated by a distinct suture; meta-furcasternum diamond-shaped, produced behind in a blunt point and set off by slight depressions from hind coxae; median sternal suture continued over meta-furcasternum. Prothoracic and metathoracic spiracles as in *Lynchia*.

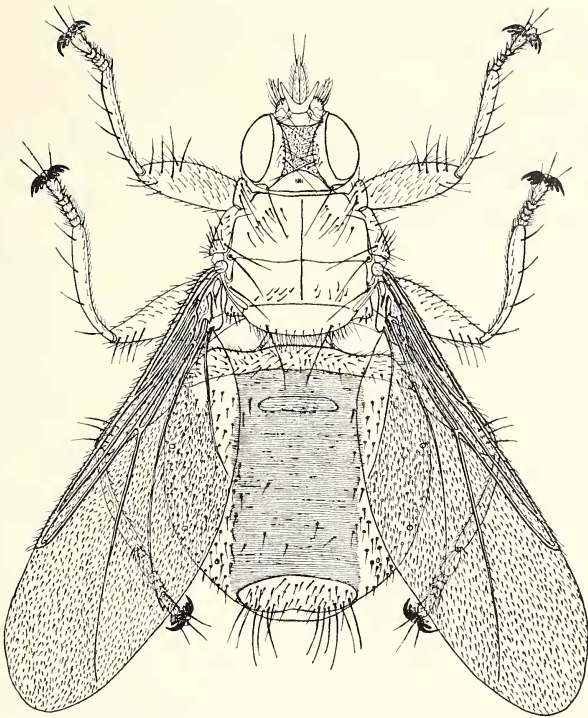


Fig. 71. *Microlynchia pusilla* (Speiser), ♀, Clayberg Co., Tex., on *Geococcyx californianus*. $\times$ about 15.

Legs and claws (Fig. 73B) as in *Lynchia*, but empodium simple, not feathered. Wing (Figs. 73A, 74B, 75A and 76A) large, with the reduced venation of *Pseudolynchia*, without posterior basal and anterior basal cross-veins; 6th longitudinal vein reduced to a basal stump (as explained for *Lynchia*); subcosta either complete or incomplete, even in the same species; 2nd longitudinal vein mostly free from costa, ending a short distance basad of tip of 3rd longitudinal; membrane extensively covered with microtrichia; alula very narrow; calypteres as in *Lynchia*. Abdomen as in *Lynchia*; dorsally with an extensive median striolate area, in which only one median sclerite is differentiated; the sclerite also shows some transverse striae, which are farther apart than those of the surrounding striolate area; in the ♀ it is short and narrow and lies close behind the fused basal laterotergites; in the ♂ it is a short but (transversely) wide strip behind mid-length, basad of the large preapical

dorsal sclerite. Chaetotaxy less developed than in *Pseudolynchia*, more as in most *Lynchia*; ♀ without soft, setigerous knob ventrally between 7th abdominal spiracle and ano-genital openings. Seven pairs of abdominal spiracles, placed as in *Lynchia*. Male terminalia (Fig. 72C), as in *Lynchia* and *Pseudolynchia*: gonocoxites rudimentary; instead a setigerous lobe (*slo*) at each side of genital atrium.

In general *Microlynchia* agrees with *Pseudolynchia* and *Lynchia*, as mentioned before; but it retains more of the characteristics of *Lynchia* than does *Pseudolynchia*. The scutellum is as in *Lynchia*, lacking the setigerous digitations at the corners; but its surface is smooth and even. The meta-furcasternum is not emarginate, but pointed behind, with a distinct longitudinal median suture. The outer margins of the meta-basisternum form no metasternal spurs near the hind coxae. The metathoracic pleurotergite is much more prominent than in either *Lynchia* or *Pseudolynchia*. The venation is essentially that of *Pseudolynchia*; but the 2nd longitudinal vein ends close to the tip of the 3rd longitudinal and its apical portion is not or only very briefly fused with the costa. The pilosity is much sparser on head and thorax than in *Pseudolynchia*. These peculiarities would seem to justify retaining *Lynchia*, *Microlynchia* and *Pseudolynchia* as distinct genera in spite of their obvious relationship. I do not attach undue importance to the presence or lack of ocelli, as these organs are unstable in several Hippoboscidae, being evidently at present in the process of disappearing in certain genera. The matter was discussed at some length under *Lynchia*.

I now regard *Microlynchia* as restricted to the New World and recognize four species. *M. furtiva* and *M. galapagoensis*, here described as new from a few specimens, appear to be very distinct. The other two, *M. pusilla* and *M. crypturelli*, are extremely similar and it is even possible that they might be conspecific. However, it seems premature to lump them at present, in view of the limited amount of hippoboscid material thus far available from tinamous, possibly the only true breeding hosts of *crypturelli*.

In an earlier paper (1938b, p. 349), I referred doubtfully to *Microlynchia* the Old World *Olfersia falcinelli* Rondani (1879, p. 23), described from an unknown host at Malta. According to Dr. B. Lanza (*in litt.*, 1953), the type is now in Rondani's collection at the Florence Museum. I have not seen it; but from the description it could scarcely have been a *Microlynchia* and was most probably a small species of *Lynchia*. I now suspect that it is the very small species of *Lynchia* which I have seen from a variety of Passeriformes

in Africa, Asia Minor and southern Europe, and of which a specimen was recently obtained in the British Isles. This parasite will be discussed fully elsewhere.

Key to Species of *Microlynchia*

1. Wing membrane without microtrichia over entire postaxillary cell and hind third of combined anal, 3rd posterior and axillary cells. Lunula and interantennal area of frons fused; interantennal area as wide as its shortest distance from an eye; apical arms short, not prong-like. Orbital bristles few, in one row. Palpi only slightly shorter than height of eye or than mediovertex. Metathoracic pleurotergite very prominent. Wing 4.5 to 4.8 mm. long *M. galapagoensis*
Only nearly entire postaxillary cell of wing membrane without microtrichia. Metathoracic pleurotergite low 2
2. Palpi longer than height of eye or of combined mediovertex and postvertex. Lunula and interantennal area of frons fused; interantennal area flat, long, wider than its shortest distance from an eye; apical arms short, very wide, not prong-like. Orbital bristles few, in one row. Wing 6.4 mm. long.

M. furtiva

Palpi shorter than the height of an eye or of the combined mediovertex and postvertex. Lunula and interantennal area of frons separated by a distinct or weak suture; interantennal area short, at most as wide as its shortest distance from an eye; apical arms long, narrow, prong-like. Orbital bristles fairly many, not all in one row 3

3. Interantennal area of frons at least as wide as an antennal pit, little or not depressed lengthwise; apical arms moderately long, rather strongly diverging and distinctly widened basally. Wing 3.8 to 4.5 mm. long *M. pusilla*

Interantennal area of frons narrower than an antennal pit, usually with a deep longitudinal groove; apical arms very long, moderately diverging and about equally wide throughout. Wing 4.5 to 5.3 mm. long *M. crypturelli*

Microlynchia pusilla (Speiser)

Figs. 3A-C, 71, 72A-F and 73A-F

Lynchia pusilla Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 157 (no sex; no host. Cuba. Type at Berlin Mus.). Aldrich, 1905, Smithsonian Misc. Coll., 46, No. 1444, p. 655. Speiser, 1907, Ent. News, 18, p. 104; 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304. Herms, 1923, Medical Veterinary Entomology, 2nd Ed., p. 351.

ENTOMOLOGICA AMERICANA

- Microlynchia pusilla* Ad. Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, p. 185; Pl. 27, fig. 2; Pl. 28, fig. 6 (Brazil: States of Rio de Janeiro, Minas Gerais and Espirito Santo; on *Columbigallina t. talpacoti*, *Leptotila rufaxilla* [= *L. r. reichenbachii*], and *Scardafella* "squamosa" [= *S. squamata squamata*]). de Beaufort, 1916, Brazil-Medico 30, p. 353 (supposed transmission of *Haemoproteus columbae* in Brazil). Lavier, 1921, Parasites Invertébrés Hématophages, p. 108. Ad. Lutz and Nuñez-Továr, 1928, Estudios Zoológica Parasitología Venezolanas, p. 9 (Venezuela, on pigeons). Ferris, 1930, Canad. Entom., 62, p. 66, figs. 3 and 4A-E (♀. Arizona: Thatcher, on domestic pigeon). J. Bequaert, 1933, Proc. California Ac. Sci., (4), 21, pt. 11, p. 135; 1938, Revista de Entomologia, Rio de Janeiro, 9, p. 345, fig. 3 (♀ ♂). Root and Huff, 1938, Parasitology Man Domestic Animals, p. 614. Carbonell, 1938, Parasitología en Venezuela y los Trabajos del Dr. M. Nuñez-Továr, p. 250. Neveu-Lemaire, 1938, Traité Entomologie Médicale Vétérinaire, p. 983. Thompson, 1938, Ent. Mo. Mag., 74, p. 46. Brennan, 1938, Science, 88, p. 571 (Texas: San Antonio and Uvalde, on *Zenaidura macroura carolinensis*). Martorell, 1939, Jl. Agric. Univ. Puerto Rico, 23, p. 221. Huff, 1939, Jl. Amer. Vet. Med. Assoc., 94, p. 619. J. Bequaert, 1939, Science, 89, p. 267; 1940, Mem. Soc. Cubana Hist. Nat., 14, pt. 4, p. 325. Coatsney and West, 1940, Amer. Jl. Hyg., 31, pt. 1, Sect. C, p. 12. J. Bequaert, 1941, Occ. Papers Bernice P. Bishop Mus., Honolulu, 16, pt. 11, p. 287. McClure, 1941, Iowa State Coll. Jl. Sci., 16, p. 95 (Iowa: on *Zenaidura macroura carolinensis*); 1943, Bull. No. 310 Iowa Agric. Expt. Sta., p. 406 (Iowa: Cass Co., on only 7 of 1700 young *Zenaidura macroura carolinensis*, none on adult birds). J. Bequaert, 1943, Bol. Entom. Venezolana, 1, pt. 4, p. 82. Neveu-Lemaire, 1943, Traité Protozoologie Médicale Vétérinaire, pp. 451 and 795. Herman, 1945, California Fish Game, 31, p. 22 (California: Brawley, on *Zenaidura macroura marginella*). Beatty, 1947, Jl. Agric. Univ. Puerto Rico, 28, (for 1944), pts. 3-4, p. 154 (St. Croix: on *Columbigallina passerina nigrirostris*). Anduze, Pifano and Vogelsang, 1947, Bol. Entom. Venezolana, Num. Extra, p. 6. Herms, 1950, Medical Zoology, 4th Ed., p. 414. J. Bequaert, 1951, Agricultura Técnica, Santiago de Chile, 10, pt. 1, (for 1950), p. 9. Schuurmans Stekhoven, 1952, Beiträge zur Fauna Perus, 3, Wissensch. Bearbeit., pp. 92 and 101 (Peru: Hacienda Huayuri, in pigeon nests). Parmalee, 1952, Trans. 17th North American Wildlife Conf., p. 180 (Texas: Brazos Co. and Robertson Co., on *Colinus v. virginianus*; Robertson Co., on *Richmondia c. cardinalis* and *Toxostoma r. rufum*). Parmalee and Price, 1953, Jl. of Parasitology, 39, p. 222 (Texas: in the Post Oak region, on *Colinus v. virginianus*). Parmalee, Hightower, Lehman and Eads, 1953, Jl. of Mammology, 34, p. 269 (Texas: Kleberg Co., on *Colinus v. virginianus*, *Mimus p. polyglottos* and *Geococcyx californianus*). Campbell and Lee, 1953, Studies on Quail Malaria, New Mexico Dept. Fish Game, pp. 52 and 70 (New Mexico: San Miguel Co., on *Callipepla squamata pallida*); 1953, Completion Report, New Mexico Project W-41-R, (mimeographed), p. 3.
- Pseudolynchia maura* Beatty, 1947, Jl. Agric. Univ. Puerto Rico, 28, (for 1944), pts. 3-4, p. 154 (St. Croix: on *Columbigallina passerina nigrirostris*). Not of Bigot, 1885.

Distribution and Specimens Examined. UNITED STATES. ARIZONA (recorded by Ferris, 1930): without precise locality on *Callipepla squamata pallida*; Phoenix, Maricopa Co., on *Pipilo a. aberti*, *Lophortyx g. gambelii*, *Molothrus ater obscurus*, *Zenaidura macro-*

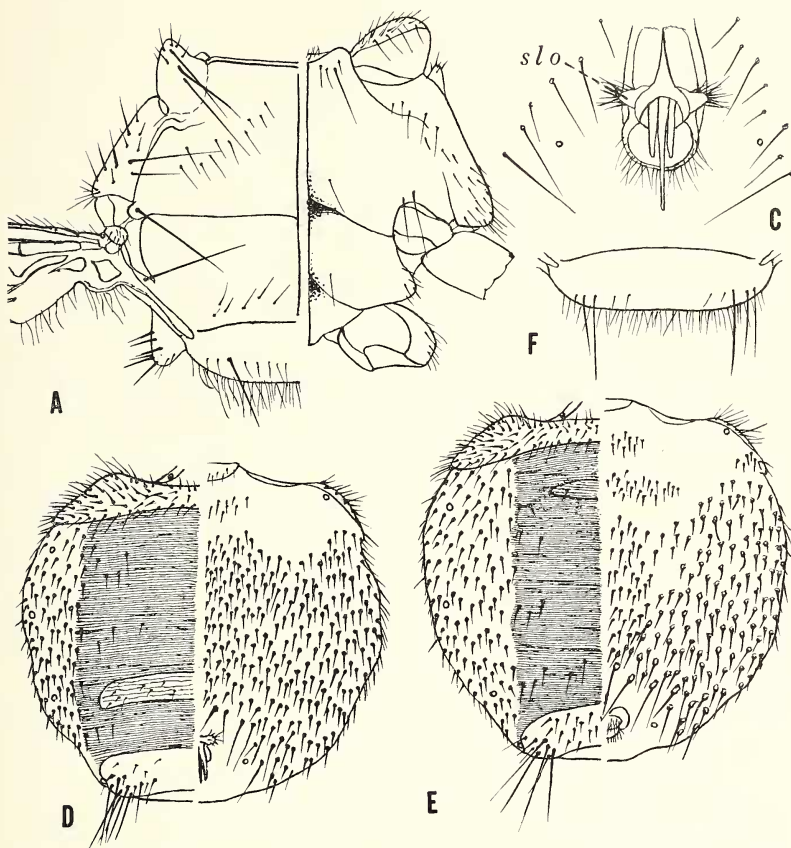


Fig. 72. *Microlynchia pusilla* (Speiser). **A**, thorax dorsally and ventrally, and base of left wing, ♀, Bexar Co., Tex., on *Zenaidura macroura carolinensis*; **B**, scutellum, ♀, St. Thomas, on *Oreopeleia mystacea beattyi*; **C**, ♂ terminalia, Conchas Dam, N. Mex., on *Callipepla squamata pallida*; **D**, abdomen dorsally and ventrally, ♂, Conchas Dam, on *C. s. pallida*; **E**, abdomen dorsally and ventrally, ♀, Sabinal, Tex., on *Geococcyx californianus*.

ura marginella (C. Stannard); Baboquivari Mts., Pima Co., (E.I. Ball); Benson, Cochise Co., on *Scardafella inca* (E.R. Tinkham); 10 miles E. of Yuma, Yuma Co., on 2 *Pipilo a. aberti* (D.P. Furman and D. J. Gould); Thatcher, Graham Co., on domestic squabs, Sept. 15. — CALIFORNIA (recorded by Herman, 1945): Coachella, Riverside Co., on *Mimus polyglottos leucopterus*, Jan. 19, *Geococcyx californianus*, and *Pipilo a. aberti*, June 16 (Mrs. B.L. Clary); Brawley, Imperial Co., on *Zenaidura macroura marginella*, Apr. 7 (G. Augustson); Calipatria, Imperial Co., on *Pipilo aberti dumeticolus*, Feb. 21 (J.N. Belkin); Shandon, San Luis Obispo Co., on *Zenaidura macroura marginella*, 1 ♂, Sept. 18 (I.B. Tarshis); Pasadena, Los Angeles Co., on *Streptopelia c. chinensis* (Mrs. Josephine R. Michener) and on *Hedymeles m. melanocephalus* (H. and J. Michener). — DISTRICT OF COLUMBIA: on *Geococcyx californianus* in the Zoological Garden; in a market on dead *Callipepla squamata pallida* imported from Arizona. — FLORIDA: Homestead, Dade Co., on *Zenaidura macroura carolinensis*, Sept. 23 (W.W. Wirth). — IDAHO: Carey, Blaine Co., Sept. 1, on *Zenaidura macroura marginella* (R. Matheson). — IOWA (recorded by McClure, 1941): Lewis, Cass Co., on *Zenaidura macroura carolinensis* (H.E. McClure). — KANSAS: Lawrence, Douglas Co., on domestic pigeon (R.H. Beamer). — NEBRASKA (recorded by Swenk, in Bequaert, 1938): Lincoln, Lancaster Co., Apr. 20, on *Zenaidura macroura marginella*, ♀ with 2 Mallophaga on left side of dorsum of abdomen (C.E. Mickel and Dawson). — NEW MEXICO (recorded by Campbell and Lee, 1953): Conchas Dam, San Miguel Co., on *Callipepla squamata pallida*, Dec. 7 (L. Lee, through D.P. Furman). — NORTH DAKOTA: Fargo, Cass Co., on *Mimus polyglottos leucopterus* (D.A. Stevens). — TEXAS (recorded by Brennan, 1938): Brownsville, Cameron Co., Aug. 2, on *Zenaida a. asiatica*; Raymondville, Willacy Co., on *Sturnella m. magna*, Apr. 20 (E.F. Knipling); 4 miles E. of Benchley, Robertson Co., on *Toxostoma r. rufum*, Nov. 26, *Richmondia c. cardinalis*, Nov. 24, and *Colinus v. virginianus* (M.A. Price); 8 miles E. of Bryan, Brazos Co., on *Colinus v. virginianus* (M.A. Price); Kleberg Co., Jan. 9–12 and Feb. 13, on *Geococcyx californianus*, *Mimus p. polyglottos*, and *Colinus v. virginianus* (B.G. Hightower); Sonora, Sutton Co., without host, Sept 21 (O.G. Babcock), and on *Pipilo fuscus mesoleucus*, Jan. 23 (F.C. Bishopp); Sabinal, Uvalde, Co., on *Geococcyx californianus*, Dec. 29 (F.C. Pratt); Menard Co., on *Geococcyx californianus*, Sept. 8 (F.C. Bishopp); San Antonio, Bexar Co., on *Zenaidura macroura carolinensis*, Sept. 12 (J.M. Brennan) and on domestic pigeon (B. Weir); Corpus Christi, Nueces Co., on *Geococcyx californianus*,

March 15 (G.K. Cherrie) and *Richmondia c. cardinalis*, July 22 (F. Harper); Whitecotton Ranch, Zavala Co., on *Geococcyx californianus* and *Toxostoma c. curvirostre* (C.W. Johnson and O.L. Walker), and on *Molothrus ater obscurus* and *Arremonops rufivirgatus* (B.G. Hightower); Uvalde, Uvalde Co., without host, Dec. 29, on sparrow hawk, March 8 (F.C. Bishopp and D.C. Parman), and on *Zenaidura macroura carolinensis*, Oct. 21 (W.L. Barrett, Jr. and R.W. Burgess); Dallas, Dallas Co., on *Geococcyx californianus*, Sept. 2 (F.C. Bishopp); Sheffield, Pecos Co., on *Callipepla squamata pallida*, Jan. 24 (H.S. Peters); [Camp Bullis near San Antonio, on *Caprimulgus carolinensis*, *Mimus polyglottus leucopterus*, *Richmondia c. cardinalis*, and *Colinus v. virginianus*. — J. M. Brennan, in litt., 1945; not seen].

MEXICO: San José del Cabo, Baja California, on *Zenaida asiatica mearnsi*, Feb. 17 (G.F. Augustson); Xocempich, 10 miles from Chichen Itza, Yucatan (D.B. Legters); near Granados, State Sonora, 1 ♀ and 1 ♂ on *Toxostoma d. dorsale*, Nov. 21 (A.R. Phillips); Clarion I., Revilla Gigedo Group (Pacific Ocean), 1 ♀ on *Zenaidura macroura clarionensis*, May 7–8 (W.A. McDonald and Blodget).

COSTA RICA: Turrialba, on wild pigeon [probably *Columba rufina pallidicrissa*] and *Arremonops striaticeps* (K.W. Cooper).

ANTILLES. CUBA (recorded by Speiser, 1902). — ST. CROIX (recorded by Beatty, 1947): on *Columbigallina passerina nigrirostris* (H.A. Beatty. — Specimens recorded by error as *Pseudolynchia maura* by Beatty, 1947) and *Oreopeleia mystacea beattyi* (H.A. Beatty; G.A. Seaman). — ST. THOMAS: on nestling *Columba leucocephala* and on *Oreopeleia mystacea beattyi* (G.A. Seaman). — GRENADA: on *Zenaidura auriculata rubripes* (F. Root).

COLOMBIA: Cali, Valle del Cauca, on domestic pigeon (S. Renjifo Salcedo).

VENEZUELA (recorded by Ad. Lutz and Nuñez-Továr, 1928): Caripito, State Monagas (P. Anduze); Santa María de Ipire, State Guarico, on *Colinus cristatus connini* (P. Anduze); Yagua, State Cojedes (H.A. Beatty).

BRAZIL (recorded by Ad. Lutz, Neiva and da Costa Lima, 1915): Deodoro, State Rio de Janeiro, on *Columbigallina* sp. (J.F. Zikan); Rio de Janeiro, D.F., on domestic pigeon; Maracajú, State Matto Grosso, on *Crypturellus* sp. (R.M. Gilmore).

PERU (recorded by Schuurmans Stekhoven, 1952): Lima, on 2 *Metropelia c. ceciliae* (W. Weyrauch); San Ramon, Valle Chamayo, 800m., on *Leptotila verreauxi decipiens* (W. Weyrauch).

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PARAGUAY: San Bernardino, on domestic pigeon (K. Fiebrig).

CHILE: Arica, on *Columbigallina cruziana* (O. Barros).

Although there are as yet relatively few records from south of the Mexican boundary, *M. pusilla* appears to be essentially a Neotropical insect. It will eventually be recognized as a common bird-fly in Central and South America, as well as in the Antilles. In the United States, it is fairly common in the southwestern area, particularly in Texas, Arizona and southern California. Farther north it is very scarce, the few sporadic occurrences being no doubt due to temporary introductions during the summer on migrating hosts. It is particularly noteworthy that the several Californian records are all from the southern third of the state. The northmost localities are in Idaho (43° 20' N.) and North Dakota (46° 50' N.). East of the Mississippi the only reliable, native record is from Florida, the two occurrences in the District of Columbia being due to transport by Man. The southmost records are from northern Chile (18° 32' S.) and Paraguay (25° 20' S.).

Known Nearectic Hosts of *M. pusilla* (verified individual records in parentheses). Falconiformes (1 unnamed hawk). Galliformes (8): *Callipepla squamata pallida* (4); *Colinus v. virginianus* (3); *Lophortyx g. gambelii* (1). Columbiformes (15): **Columba l. livia* (3); *Scardafella inca* (1); **Streptopelia c. chinensis* (1); *Zenaida a. asiatica* (1); *Zenaidura macroura carolinensis* (4); *Z. macroura marginella* (5). Cuculiformes (8): *Geococcyx californianus* (8). Caprimulgiformes: *Caprimulgus carolinensis*. Passeriformes (18): *Arremonops rufivirgatus* (1); *Hedymeles m. melanocephalus* (1); *Mimus p. polyglottos* (1); *M. polyglottos leucopterus* (2); *Molothrus ater obscurus* (2); *Pipilo a. aberti* (4); *P. aberti dumeticolus* (1); *P. fuscus mesoleucus* (1); *Richmondia c. cardinalis* (2); *Sturnella m. magna* (1); *Toxostoma c. curvirostre* (1); *T. r. rufum* (1).

Known Neotropical Hosts of *M. pusilla*. Tinamiformes (1): *Crypturellus* sp. (1). Galliformes (1): *Colinus cristatus sonnini* (1). Columbiformes (15 and 1 unnamed pigeon): *Columba leucocephala* (1); **C. l. livia* (3); *Columbigallina* sp. (1); *C. cruziana* (1); *C. passerina nigrirrostris* (1); *C. t. talpacoti*; *Leptotila rufaxilla reichenbachii*; *L. verreauxi decipiens* (1); *Metropelia c. ceciliae* (2); *Oreopeleia mystacea beattyi* (2); *Scardafella s. squammata*; *Zenaida asiatica mearnsi* (1); *Zenaidura articulata rubripes* (1); *Zenaidura macroura clarionensis* (1). Passeriformes (2): *Arremonops striaticeps* (1); *Toxostoma d. dorsale* (1).

Bionomics. Part I mentions what little is known of the natural

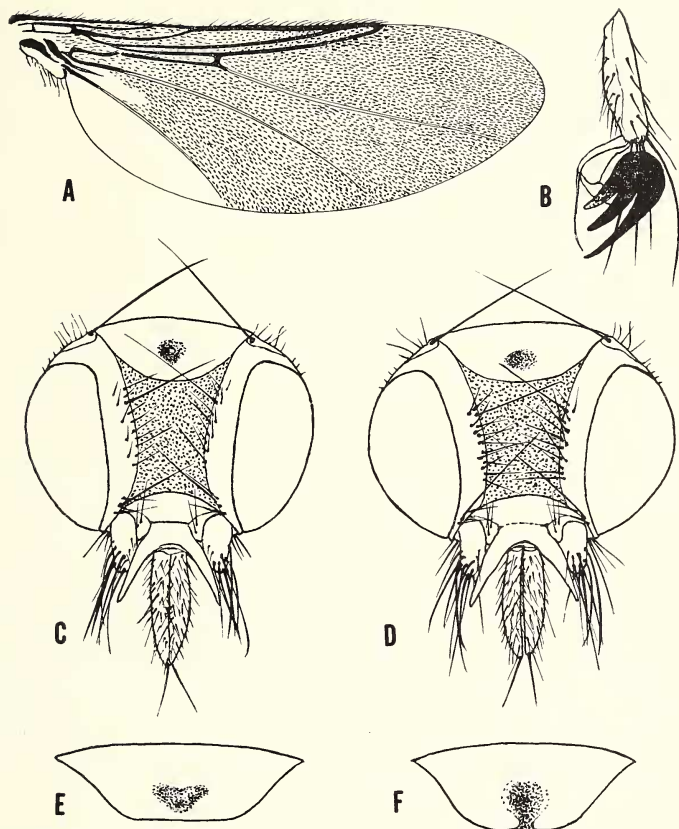


Fig. 73. *Microlynchia pusilla* (Speiser): **A**, wing, ♀, San Antonio, Tex., on *Zenaidura macroura carolinensis*; **B**, distitarsus and claw of hind leg, ♀, Sabinal, Tex., on *Geococcyx californianus*; **C**, head, ♀, Turrialba, Costa Rica, on wild pigeon, postvertex with 1 distinct vestigial ocellus; **D**, head, ♂, Bexar Co., Tex., on *Zenaidura macroura carolinensis*, postvertex with very small ocellus; **E**, postvertex, ♂, Arizona, on *Callipepla squamata pallida*, with 2 minute posterior ocelli; **F**, postvertex, ♀, St. Croix, on *Columbigallina passerina nigrirostris*, with large pit, but no trace of vestigial ocelli.

history of *M. pusilla*, under the following headings: possible transmission of *Haemoproteus columbae* (p. 138) and the *Haemoproteus* of wild doves (pp. 357-358); infestation with Laboulbeniales (p. 141) and mites (p. 159); frequency and density on the host (p. 233); seasonal fluctuations (p. 256); acquisition of new hosts (p. 245); and host specificity (p. 324). Larviposition has not been observed and the puparium is unknown.

In spite of the paucity of records, particularly from the Neotropics, which are probably its main range, this fly is clearly a pleioxenous parasite, with regular breeding hosts in at least 3 and possibly 4 orders of birds. It is remarkable that it seems to shun diurnal and nocturnal Raptores. In the Nearctic Region it breeds chiefly on Columbiformes (5 species with 15, or 30 per cent, of the 50 verified records), Galliformes (3 species with 8, or 16 per cent of the records), and one of the Cuculiformes (*Geococcyx*, the road-runner, with 8, or 16 per cent, of the records). It occurs rather frequently on Passeriformes (10 species with 18, or 36 per cent, of the records) and possibly some of these, such as *Pipilo aberti*, may also be used for breeding; but it is always much rarer on them than either *Ornithoica vicina* or *Ornithomyia fringillina*. In the Neotropics the majority of the records are from Columbiformes (13 species with 15, or 79 per cent, of the 19 verified records). The sporadic single occurrences on 3 other orders are probably accidental; but it seems strange that the fly would avoid Passeriformes almost completely in the tropics, when it is often found on some of these birds in the Nearctic Region. One fly said to have come from a tinamou in Brazil I am unable to distinguish from the other *M. pusilla*; yet it is far from settled that *M. crypturelli*, here regarded as a specific parasite of tinamous, is specifically distinct from *M. pusilla*. The natural partiality for Columbiformes no doubt explains the repeated findings of *M. pusilla* on the introduced domestic pigeon in North as well as in South America.

In the southern United States the fly is often found on birds during November, December, January, February, March and April, as well as during the summer, so that the adult evidently winters there on some of the hosts. In the northern states the fly is much rarer and has been taken only from April 20 to September 1. McClure (1943, p. 406) remarked on its scarcity in Iowa, where he found it only on 7 of some 1700 young mourning doves handled for banding.

The following cases of mite infestation are additional to the one mentioned in Part I:

2. Female fly on *Mimus polyglottos leucopterus*, at Fargo, North Dakota, with one mite cluster on under side of a basal vein in each wing.

3. One ♀ and 1 ♂ on *Oreopeleia mystacea beattyi*, in St. Croix, with a mite cluster on under side of a basal vein, in both wings in the ♂, in one wing only in the ♀.

The first case of phoresy of Mallophaga by *M. pusilla* was noticed recently. A ♀ taken on *Zenaidura macroura marginella*, at Lincoln, Neb., carried 2 lice fixed to the left dorsal side of the abdomen.

Affinities. The very close relationship of *M. pusilla* and *M. crypturelli* will be discussed under the latter. *M. pusilla* varies relatively little in size, the wing being 3.8 to 4.5 mm. long and 1.5 to 1.7 mm. wide. The interocular face is usually at its narrowest (at the lower third) about $1\frac{2}{3}$ times, and at its widest nearly twice the width of an eye in the ♀ (Fig. 73C) and slightly narrower (nearly $1\frac{1}{2}$ times as wide as an eye) in the ♂ (Fig. 73D); but there is so much variation in this respect in both sexes that this width can scarcely be used to separate them. The inner margins of the eyes are slightly farther apart at the postvertex than at the lunula. The venation varies little, except in the ending of the subcosta. A series of 64 flies examined for this character is about evenly divided in those with complete and those with incomplete subcosta. The vein is complete in both wings in 31 flies (13♀ and 18 ♂) from Arizona, California, Texas, Mexico, St. Thomas, St. Croix, Venezuela and Colombia, on domestic pigeon, *Callipepla squamata*, *Columbigallina*, *Oreopeleia mystacea*, *Zenaidura macroura*, *Colinus cristatus*, *Geococcyx californianus*, and *Hedymeles melanocephalus*. It is incomplete in both wings in 31 flies (23 ♀ and 8 ♂) from Arizona, New Mexico, North Dakota, Texas, St. Thomas, Costa Rica, Venezuela, Brazil and Paraguay, on domestic pigeon, *Callipepla squamata*, *Crypturellus*, *Geococcyx californianus*, *Arremonops striaticeps*, *Mimus polyglottos*, and *Pipilo aberti*. The remaining 2 flies, both ♀, from St. Croix, on *Columbigallina passerina*, and from Texas, on *Zenaidura macroura*, have the vein complete in one wing and incomplete in the other. When incomplete the vein is often much shortened; but occasionally it stops just short of the costa or fades out very gradually. The first section of 4th longitudinal vein is nearly as long as the last section of the 3rd longitudinal.

Normally the scutellum has one pair of discal (or preapical) bristles (1 in each corner), in addition to some very short, soft

setulae (Fig. 72A). Of 5 flies taken on one *Mimus polyglottos leucopterus* at Fargo, N. Dak., 1 ♀ and 1 ♂ have the normal pair; 1 ♀ has 2 pairs (4 bristles in all); and 2 ♀ have 3 bristles (1 in one corner and 2 in the other). Of 9 flies from *Oreopeleia mystacea beattyi* in St. Thomas, only 1 ♀ has the normal pair; 5 ♀ and 2 ♂ have 2 pairs (4 bristles in all); and 1 ♀ has 5 bristles in all, 2 in one corner and 3 in the other (Fig. 72F). Such specimens are evidently abnormalities, as I was unable to detect any other difference between them and the flies with one pair of bristles.

The median dorsal sclerite of the abdomen is variable in size and shape in the ♀, although in most specimens it is about as shown in Fig. 72E. In one ♀ from Yuma, Ariz., on *Pipilo a. aberti*, it is greatly reduced and divided into two plates barely connected across the middle.

M. pusilla is often fairly regularly marked with pale, bone-white spots, which cover most of frons (except for black tips of apical arms), inner orbits, postvertex, humeral callosities, dorsal anepisternum, squarely triangular antero-lateral areas of prescutum, anterior face of fore femora and fore tibiae, upper side of fore tarsi, and anterior half or more of scutellum. These markings are, however, lacking in some specimens, and these do not differ in any structural peculiarity from the spotted flies.

Speiser (1902) stated merely that the "vertex" (= postvertex) was "medially with a pit." Lutz, Neiva and da Costa Lima (1915) first called attention to the "presence of ocelli, albeit poorly visible, at the bottom of the small pit described by Speiser." They used this as one of the characters separating their new genus *Microlynchia* from *Pseudolynchia* (their "*Lynchia*"). Ferris (1930c, p. 66) commented on this as follows: "The presence of the ocelli, if it were not a variable character, would separate the genus from all its immediate relatives except *Ornithophila*. Of the 3 specimens [from Thatcher, Ariz., on domestic pigeon] examined in slide preparations, which make detailed study possible, one lacks the ocelli entirely, their position being indicated by a pore-like pit similar to that which is present in some species of *Lynchia* (= *Olfersia* of authors); one has 3 minute but quite distinct ocelli and the third has 2. In the latter cases the ocelli are borne in a distinct pit." My own observations only confirm Ferris' conclusion. A deep pit, variable in size, is present on the postvertex of all flies examined; in a very few the pit shows no trace of ocelli; in most of them there are from 1 to 3 vestigial ocelli, very variable in size, but always placed in the pit, either crowded together or farther apart. If

only one ocellus is present in the center of the pit, it is sometimes large and quite convex. Figs. 73C-F show some of these conditions, as well as variations in the shape of the postvertex.

Original description of *L. pusilla* (translated from the German): "Length of body, 3 mm.; from oral margin to hind margin of scutellum, nearly 2 mm.; of wing, nearly 4 mm. Ground color umber-brown, with paler head, a pale longitudinal line on thorax, pale contrasting anterior angles and pale fore margin of scutellum; legs pale leather-yellow. Head only slightly narrower than thorax, with evenly rounded vertex [occipital margin]. Frons [interocular face] very little narrowed anteriorly, somewhat dull medially [mediovertex], shiny along the margins of the eyes [inner orbits] and on the triangle of the vertex [postvertex]; the latter broadly rounded anteriorly, with entire margin, medially with a pit. Clypeus oris [frons] divided as usual by a transverse suture into two parts, the anterior part ending in a deep and acute emargination, so that it consists mostly of two bone-yellow, divergent tips which extend beyond the antennal appendages. Antennal appendages very small, shiny chestnut-brown, with black bristles. Maxillary palpi half the length of the frons [interocular face], straight, of medium width, brown with basal half paler above. The pattern of the thorax recalls that of *Olfersia* [= *Lynchia*] *americana* Leach, as figured by Leach, being similarly variegated and divided. The ground color is umber-brown, with leather-yellow median line, yellowish-brown anterior edges not only on the humeral lobes [callosities] but also over the adjoining areas of the prescutum; the yellowish-brown color stops nearly rectangularly inside. Fore margin of scutellum also with a narrow yellowish-brown edge. Anterior margin of thorax straight, with only the humeral lobes [callosities] projecting on each side; longitudinal [median notal] suture very fine; transverse [meso-notal] suture almost at right angles with it, groove-like laterally, very fine but not effaced medially. Scutellum scarcely truncate, nevertheless shorter in proportion to its width than in a true *Olfersia* [= *Lynchia*]. No characteristic pilosity. Legs pale; claws with accessory tooth. Fore femora with a row of short, stiff bristles, placed at right angles with the long axis, setting off a basal bare portion from a peripheral setose area. The other legs appear bare. Wings slightly tinged with grayish hazel-brown, without peculiarities. Radialis [2nd longitudinal] ending so close to the cubitalis [3rd longitudinal] that the apical section of the costa is less than half as long as the penultimate section. No other observations on the venation. Abdomen hidden from view by the folded wings." I have not seen the type, which should be at the Berlin Museum. It should be examined more critically, as the original description mentions little beyond color. My interpretation of *M. pusilla* follows that of Lutz, Neiva and da Costa Lima (1915) and of Ferris (1930). There is no reason to doubt that it is correct.

Microlynchia crypturelli J. Bequaert

Figs. 74A-E

Microlynchia crypturelli J. Bequaert, 1938, Rev. de Entomologia, Rio de Janeiro, 9, p. 346, figs. 1-2 (♀; on *Crypturellus soui panamensis*. Panama: La Vaca, Chiriqui Prov. Holotype and 1 paratype at Mus.Comp.Zool., Cambridge, Mass.; 1 paratype at U.S.Nat.Mus., Washington); 1940, Rev. Acad. Colombiana Cienc. Ex. Fis. Nat., 3, No. 12, p. 416; 1943, Jl. of Parasitology, 29, p. 131.

Distribution and Specimens Examined. PANAMA: La Vaca, Chiriqui Prov., R.P., on *Crypturellus soui panamensis*, ♀ holotype and 2 ♀ paratypes (L.H. Dunn.—Mus.Comp.Zool., No. 29434).

BRAZIL: Nova Teutonia near Itá, State Santa Catharina, on *Crypturellus o. obsoletus* and 6 ♀ and 3 ♂ (including the allotype) on *Columba rufina sylvestris* (F. Plaumann. — Allotype at Mus.-Comp.Zool., No. 29434); Fazenda Recreio, Coxim, State of Matto Grosso, on *Crypturellus parvirostris* (J. Lima).

No doubt *M. crypturelli* is more widely distributed in tropical America than the few available records indicate. If it is a specific parasite of tinamous, as I suspect, it may be difficult to collect because of the secretive habits of these forest birds.

Bionomics. The few host records of *M. crypturelli* are mostly from tinamous (Tinamiformes, Tinamidae): *Crypturellus o. obsoletus* (1); *C. parvirostris* (1); *C. soui panamensis* (1). It seems probable that these birds are the true and perhaps only breeding hosts, but further observations are needed to confirm this. The specimens reported from a wild dove, *Columba rufina sylvestris*, in Brazil, were said to have come from 3 birds at different dates; they may nevertheless have been accidental, or perhaps due to *post mortem* contaminations or to some oversight in labeling. I now disregard also the occurrence on one of the Phasianidae, *Odontophorus c. capueira*, at Nova Teutonia, recorded in an earlier paper (1943c, p. 131), as this was based on an oversight.

In Part I (p. 159) I mentioned a case of infestation with mites. Not much else is known of the life history.

Affinities. As mentioned before, *M. pusilla* and *M. crypturelli* are very similar and I am far from satisfied that they are specifically distinct. The only differences now regarded as reliable are given in the key. Unfortunately these are mostly of degree, hence difficult to appreciate when both species are not available for comparison. The problem is also complicated by the fact that, while *crypturelli* presumably breeds only on tinamous, *pusilla* seems to occur occasionally (perhaps as a stray) on the same type of bird.

Revised description. *Female.* Head (Fig. 74C) in front view about as wide across eyes as high from occipital margin to tips of apical arms of frons; interocular face at its narrowest slightly over $1\frac{1}{4}$ times as wide as an eye, nearly as high along inner orbits as its greatest width at postvertex; eyes farther apart at postvertex than at lunula, nearest to each other at lower third; inner orbits slightly less than half as wide as mediovertex; orbital bristles few and mostly weak: a short row of 3 or 4 (one very long) near lunula; 12 to 15 (one very long) higher up, mostly in one row near edge of mediovertex, but some farther outside in an irregular second row; one long vertical bristle; postvertex semi-elliptical, slightly less

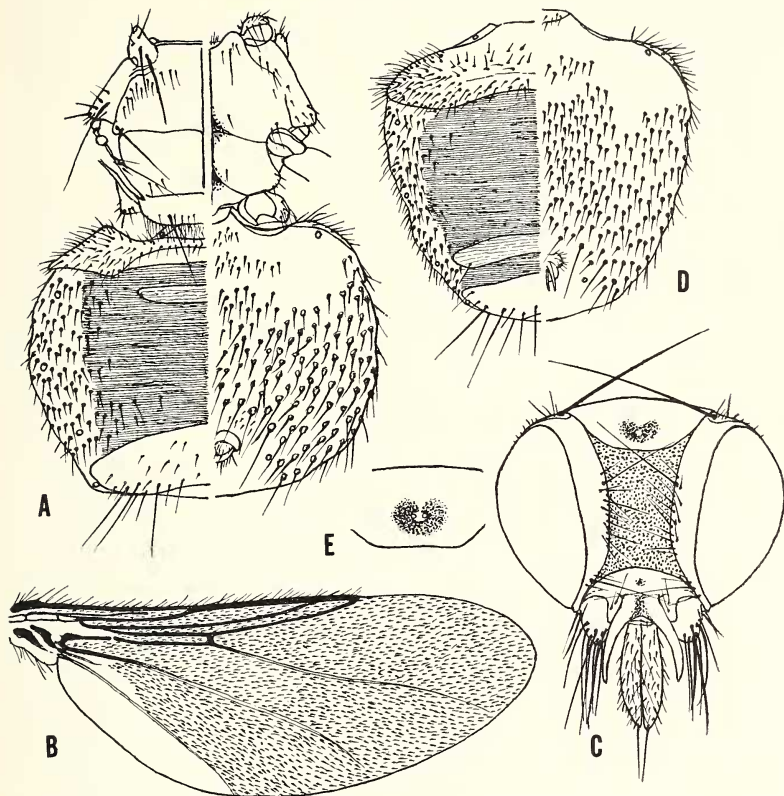


Fig. 74. *Microlynchia crypturelli* J. Bequaert: **A-C**, ♀ holotype, La Vaca, Panama, on *Crypturellus soui panamensis*; **A**, thorax and abdomen dorsally and ventrally; **B**, wing; **C**, head; **D-E**, ♂, Nova Teutonia, Brazil, on *Columba rufina sylvestris*; **D**, abdomen dorsally and ventrally, allotype; **E**, pit of post-vertex of another ♂ with 2 vestigial ocelli.

than half as long as mediovertex, with slightly convex occipital margin and evenly, broadly rounded anterior margin; disk with an irregular pit variable in size and shape, usually more or less horse-shoe-shaped; the bottom of the pit is raised into a low tubercle, either without or with 1 to 3 vestigial ocelli (2 ocelli in Fig. 74E). Frons: lunula and interantennal area very superficially separated by a transverse suture; basal portion of interantennal area narrower than its shortest distance from the eyes, with a distinct longitudinal groove; apical arms long, narrow, prong-like, nearly straight, extending far beyond tips of antennae. Palpi moderately long, slightly shorter than mediovertex. Antennae short: 1st segment almost completely fused with lunula, with a few setulae; 2nd segment nearly twice as long as 1st, moderately bristly over outer apical half. Thorax (Fig. 74A): anterior margin of prescutum nearly straight; humeral callosities moderately broad, short, obtusely pointed at apex, with a few short, stiff setae anteriorly and 2 long bristles on the disk; mesonotum as in *M. pusilla*. Scutellum transversely rectangular, about 4 times as wide as long; sides broadly rounded off; hind margin very slightly curved inward; edge below with a fringe of soft setulae; disk with one long preapical bristle on each side in a line with a few very weak setulae. Metathoracic pleurotergite broadly conical, a little over half as long as scutellum, with a few stiff, short setae. Sternum: meta-basisternum without metasternal spurs. Wing (Fig. 74B): microtrichia over most of membrane; only entire postaxillary cell, a very small basal area in the combined anal, 3rd posterior and axillary cells, and extreme base of 1st basal cell bare; 1st section of 4th longitudinal vein shorter than last section of 3rd; subcosta incomplete, not reaching costa (in both wings of 12 flies examined), sometimes much shortened and ending opposite the beginning of 3rd longitudinal. Legs as usual. Abdomen (Fig. 74A): basal fused laterotergites expanded at the sides as diamond-shaped lobes, the hind margin evenly and very broadly emarginate medially; median transversely striolate area very broad, with very few setae; sides of dorsum with mostly short setae on medium-sized papules; preapical tergite large, transversely elliptical, with a few very short setae and on each side an apical group of 4 or 5 long bristles; venter soft and membranous, sparsely setose in the middle, more densely at the sides and toward the apex, where the setae are inserted on fairly large, prominent tubercles. Length from tips of apical arms of frons to hind margin of scutellum, 2 to 2.4 mm.; of wing, 4.4 to 5.3 mm.; width of wing, 1.8 to 2 mm.

Male. Very similar to the ♀, except as follows. Abdomen (Fig. 74D) dorsally with the basal fused laterotergites about equally long throughout, the hind margin not emarginate but only slightly curved inward medially; median sclerite differentiated in the striolate area very broad (transversely), short, ribbon-like, placed far back, toward the large preapical tergite, its surface also with superficial, spaced transverse striae; ventrally with many setae on medium-sized papules, not on prominent tubercles. Length from tips of apical arms of frons to hind margin of scutellum, 2 to 2.2 mm.; of wing, 4.4 to 4.6 mm.; width of wing, 1.5 to 1.8 mm.

In all *crypturelli* seen the 1st (basal) section of the 4th longitudinal vein is much shorter than the last (apical) section of the 3rd; in most *pusilla* these 2 sections are about the same length, but some of them scarcely differ in this respect from *crypturelli*. The postaxillary cell at its widest is narrower than the combined anal, 3rd posterior and axillary cells at the same level in *crypturelli*, while in *pusilla* these 2 cells are about equally wide. Other supposed differences mentioned in the original description, copied below, have proved untenable.

Original description of *M. crypturelli*: "*Female.* Head seen in front less than $1\frac{1}{2}$ times as wide as high; frons at its narrowest about $1\frac{1}{2}$ times as wide as the eye, measured along inner orbits a little longer than its greatest width at the vertex, the sides strongly converging from vertex to fronto-clypeus; inner orbits (parafrontalia) about half as wide as the mediovertex (frontalia), mostly smooth and bare, the inner margin with a few short soft setae, placed in one irregular row, and two long bristles, one at the lower third, the other near the ptilinal suture; one long vertical bristle; postvertex (vertical triangle) long, semi-elliptical, about half the length of the mediovertex, the anterior margin evenly rounded off, the occipital margin slightly convex, the disk with a slight median tubercle, limited on the sides and anteriorly by an irregular, furcate depression; the very small, rudimentary ocelli are crowded together on this median tubercle; anterior portion of fronto-clypeus narrowly and very deeply emarginate in the middle, the antero-lateral angles forming very long, narrow, straight prongs, which extend far beyond the tips of the antennae. Palpi moderately long, about half as long as the height of the head (measured from occipital margin to bottom of emargination of fronto-clypeus). Antennae short, of normal shape. Thorax of the usual shape; anterior margin nearly straight; humeral lobes moderately long, broad, obtusely pointed at apex; transverse and longitudinal grooves of mesonotum deep and nearly complete. Scutellum transversely rectangular, about 4 times as wide as its length in the middle, the anterior (mesonotal) margin slightly convex, the sides broadly rounded off, the hind margin very slightly concave. Humeral lobes with a few short setae at apex and a long bristle before the middle; anterior half of mesonotum (prescutum) with a few short, soft hairs on the sides in a transverse patch; one very long prealar and one very long postalar bristle; dorsal portion of mesopleura (notopleura) posteriorly with a few short and one very long bristles; scutellum with an apical fringe of long hairs and one long scutellar bristle on each side; metepimeron with 4 or 5 short, stiff bristles. Integument of entire mesonotum minutely and rather regularly, obliquely striolate. Legs without distinctive features, moderately long. Wing short and

broad; microtrichia covering most of the membrane, only the axillary cell, part of the base of the combined anal and 5th [correctly 3rd] posterior cells, and extreme base of 1st basal cell bare; 1st basal cell long, narrow, parallel-sided; subcosta incomplete or much weakened apically, not reaching the costa; 1st (basal) section of 4th longitudinal vein shorter than last (apical) section of 3rd longitudinal vein; costa densely setulose; other veins bare. Abdomen with a broad, short basal tergite, widened into truncate lateral lobes and very evenly and broadly emarginate in the middle; remainder of dorsum mostly soft and membranous, with faint traces of segmentation and a well-defined transversely elliptical median sclerite a short distance behind the basal tergite; the median area bare and microscopically transversely striolate; the softer sides covered with short setae arising from papulae; preanal tergite forming a single, transversely elliptical sclerite, bearing a few very short setae and on each side a preapical row of 4 or 5 long bristles; venter soft and membranous, sparsely setulose in the middle, more densely on the sides and with a few longer bristles posteriorly. Total length, from notch of fronto-clypeus to apex of abdomen (dry, pinned specimen): 3 mm.; length of wing: 4.6 mm.; width of wing; 1.5 mm. The main differences between this species and *M. pusilla* are pointed out in the key. In addition, the ocelli of *M. crypturelli* are more rudimentary than in *M. pusilla*; the postvertex is longer and more evenly rounded off anteriorly; the hind margin of the scutellum is slightly curved inward; and the sculpture of fine striae is more extensive over the mesonotum. In the specimens seen the subcosta is incomplete, but this peculiarity does not appear to be of specific value in *Microlynchia*." The original description is copied here only for the sake of completeness. The revised description given above should be used for the true characters of the species.

Microlynchia furtiva, new species

Figs. 75A-C

Female. Head (Fig. 75C) in front view about as wide across eyes as high from occipital margin to tips of apical arms of frons. Interocular face at its narrowest nearly twice as wide as an eye, nearly as high along inner orbits as its greatest width at postvertex; eyes slightly farther apart at postvertex than at lunula, nearest at about mid-length. Inner orbits about $\frac{1}{4}$ of width of mediovertex at its narrowest; orbital bristles few, mostly weak: a group of 3 (one very long) near lunula; 10 on each side farther up near edge of mediovertex (one very long), in one row. Postvertex only slightly over twice as wide as long, semi-elliptical, with slightly arched occipital and evenly rounded anterior margin, with an irregular antero-median pit in which no vestigial ocelli can be traced; one long vertical bristle. Frons: lunula completely fused with inter-antennal area; the portion between the antennae long and very wide, wider than its shortest distance from eyes, the surface very shallowly depressed medially; apical arms broad, short, strongly diverging, separated basally by a narrow, almost semicircular notch, rather abruptly narrowed to short, triangular points which extend moderately beyond the tips of the antennae. Palpi very long, longer than height of eye, about as long as combined mediovertex

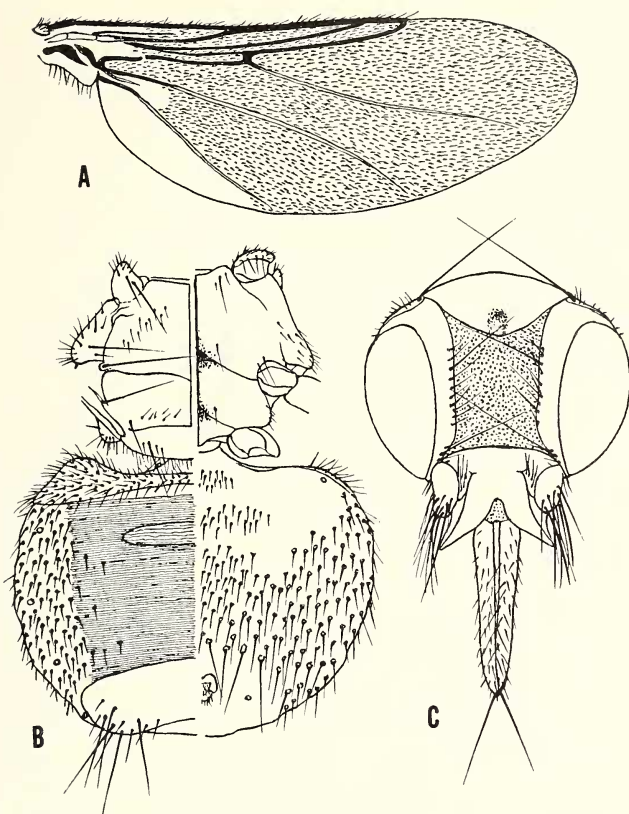


Fig. 75. *Microlynchia furtiva* J. Bequaert: **A-C**, ♀ holotype, El Cayo, Honduras, on *Crypturellus b. boucardi*: **A**, wing; **B**, thorax and abdomen dorsally and ventrally; **C**, head.

and postvertex (from occipital margin to ptilinal suture). Antennae: 1st segment fused with sides of lunula, with a few setulae; 2nd segment nearly twice as long as 1st, broadly rounded-truncate at apex, moderately bristly over outer apical half. Thorax (Fig. 75B) as usual in *Microlynchia*: anterior margin of prescutum nearly straight medially; humeral callosities moderately wide, short, slightly produced anteriorly, ending in blunt, rounded points, with a few short setae anteriorly and 2 long bristles on disk; anepisternum with a few short setae and one long discal bristle posteriorly; one long notopleural bristle; one long postalar bristle; a small, oblique patch of short appressed setae on each side of prescutum; a few small setae in a prescutellar group on each side and,

in this, a long stiff bristle in each hind corner (this bristle, not found in any of the congeners, may be an individual abnormality and not a specific character). Scutellum as in *M. pusilla*, with a lower apical fringe of soft setulae and one long, stiff discoscutellar bristle in each corner in a row with a few short, soft preapical setulae; surface even, very slightly convex; hind margin with a very slight outward curve. Metathoracic pleurotergite moderately prominent, forming a low, broad cone, not quite half as long as scutellum, with a few short, stiff setae apically. Sternum as in *M. pusilla*; meta-basisternum without metasternal spurs. Legs longer and more slender than in *M. pusilla*, without special features. Wing (Fig. 75A): only postaxillary cell bare, except for a few microtrichia at extreme tip; subcosta incomplete in both wings; venation as in *M. pusilla*. Abdomen (Fig. 75B) as in the congeners; median sclerite differentiated in the striolate area close behind the fused basal laterotergites, large, transverse, with spaced, rather well-defined transverse striae.

Length from tips of apical arms of frons to hind margin of scutellum, 3.3 mm.; of wing, 6.4 mm.; width of wing, 2.7 mm.

BRITISH HONDURAS: El Cayo, ♀ holotype on *Crypturellus b. boucardi* (J. Van Tyne Coll. — Mus.Comp.Zool., Cambridge, Mass., No. 29239; preserved in alcohol).

Remarkable for the very long palpi and the peculiar structure of the frons. It is the hippoboscid with the longest palpi as compared to the total length of the head, even exceeding in this respect the Oriental *Lynchia longipalpis* (Macquart) (= *L. majuscula* J. Bequaert).

***Microlynchia galapagoensis*, new species**

Figs. 76A-D

Female. Head (Fig. 76C) in front view about as wide across eyes as high from occipital margin to tips of apical arms of frons. Interocular face at its narrowest about twice as wide as an eye, nearly as high along inner orbits as its greatest width at postvertex; eyes slightly farther apart at postvertex than at lunula, nearest together at about mid-length. Inner orbits a little less than half as wide as mediovertex at its narrowest; orbital bristles few, mostly weak, in one row: a group of 3 (middle one long) near lunula; 8 along edge of mediovertex, mostly very weak, but one long and stiff near upper third of face. Postvertex about 3 times as wide as long, transversely semi-elliptical, with slightly arched occipital and nearly straight anterior margin; an antero-median pit with a minute, but

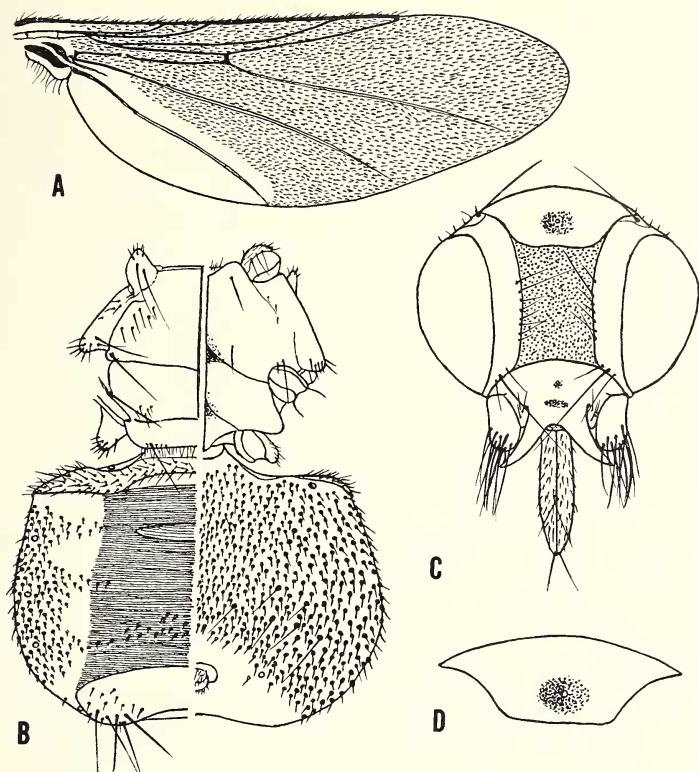


Fig. 76. *Microlynchia galapagoensis* J. Bequaert: **A-C**, ♀ holotype, Indefatigable I., Galapagos, on *Nesopelia galapagoensis*: **A**, wing; **B**, thorax and abdomen dorsally and ventrally; **C**, head; **D**, postvertex with vestigial ocellus in a pit, ♀ paratype, Hood I., Galapagos, on *Buteo galapagoensis*.

distinct vestigial ocellus in the bottom (Fig. 76D). Frons: lunula and interantennal area completely fused, the suture replaced by a broad depression; above this a very small discal pit; area between antennae moderately long, as wide as its shortest distance from eyes, scarcely depressed; apical arms moderately wide, short, strongly diverging, separated basally by a broad notch, gradually narrowed to the apices. Antennae: 1st segment fused with sides of lunula, with a few setulae; 2nd segment nearly twice as long as 1st, broadly rounded-truncate at apex, moderately bristly over outer apical half. Palpi longer than in *M. pusilla* and *M. crypturelli*, but much shorter than in *M. furtiva*, shorter than height of eye, slightly shorter than mediovertex. Thorax (Fig. 76B) as in the

congeners: humeral callosities broad, short, moderately produced anteriorly, ending in blunt, rounded points, with a few short setae anteriorly and 2 long discal bristles; anepisternum with a few short setae and one long discal bristle posteriorly; one long notopleural bristle; one long postalar bristle; an oblique patch of spaced, appressed, short setae on each side of prescutum; a few small setae in a prescutellar group on each side of mesoscutum. Scutellum somewhat shorter and broader than in the congeners, with the usual apical fringe of soft setulae and one long discal bristle on each side in a row of weak præpical setae; surface even, very slightly convex; hind margin nearly straight. Metathoracic pleurotergite very prominent, more so than in the congeners, forming a broadly rounded lobe, about as long as scutellum, setulose apically. Sternum as usual in the genus; no metasternal spurs. Legs relatively long and slender, without peculiarities. Wing (Fig. 76A) more extensively bare than in the congeners, not only over entire post-axillary cell, but also over most of hind third of combined anal, 3rd posterior and axillary cells (except near tip of axillary vein); subcosta complete in both wings in holotype and paratype; venation as usual. Abdomen (Fig. 76B): one median sclerite differentiated in the striolate area, a short distance behind the fused basal laterotergites, with spaced, coarse transverse striae; setae of the softer sides mostly short and thick, inserted on strong tubercles, both on dorsum and venter; ventrally on each side at about mid-length with 5 or 6 long setae on tubercles amongst the shorter setae; apical tergite shorter and wider than usual, mostly bare, at the sides only with a few setulae and 5 or 6 long, stiff bristles.

Length from tips of apical arms of frons to hind margin of scutellum, holotype, 2.6 mm. (paratype, 2.6 mm.); of wing, holotype, 4.8 mm. (paratype, 4.5 mm.); width of wing, holotype, 1.5 mm. (paratype, 1.4 mm.).

GALAPAGOS: Academy Bay, Indefatigable I., ♀ holotype on *Nesopelia galapagoensis* (Crane Pacific Exped. — Mus.Comp.Zool., Cambridge, Mass., No. 29432); Hood I., ♀ paratype on *Buteo galapagoensis* (W.S. Brooks. — Mus.Comp.Zool., Cambridge, Mass., No. 29432).

This species is well defined by the characters given in the key. The more extensive bare area of the wing and the prominent metathoracic pleurotergite are especially diagnostic.

Pseudolynchia J. Bequaert, 1926

Lynchia Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 155. Not of Weyenbergh, 1881.

Pseudolynchia J. Bequaert, 1926, *Psyche*, **32**, (for 1925), p. 271 (type by original designation: *Olfersia maura* Bigot, 1885 = *Olfersia canariensis* Macquart, 1840).

Generic Characters. Fully-winged parasites of birds, agreeing with *Lynchia*, except as noted here. Integument of head and thorax sometimes with metallic-green sheen, never with enamel-white areas; haemolymph without dull-greenish pigment. Ocelli lacking; anterior margin of postvertex with a median emargination sometimes extended to a small discal pit. Frons divided by a distinct transverse suture into a lunula and a narrower interantennal area; the latter deeply emarginate, ending in two short, diverging apical arms. Under side of head (Figs. 81*B* and *F*) with the facial ridge (which continues the apical arms of the frons ventrally) ending in a protuberant, somewhat lobate *vibrissal angle* (*van*, corresponding to the insertion of the vibrissa in Muscoidea). Antennae short: 1st segment completely set off by a suture from lunula, with a few setulae; second segment short, broadly rounded or subtruncate at apex, not extending beyond lower margin of antennal pit, the outer margin with a long dorsal furrow (*AF* in Fig. 78*H*, corrected from Fig. 11*F*); arista of 3rd segment ending in a flattened, ovate, thin, transparent spatula (Fig. 6*C*). Dorsum of thorax (Fig. 78*A*) as in *Lynchia*, including the fusion of notopleuron and prescutum and the single notopleural bristle borne on a rounded lobe. Scutellum large, transverse, nearly rectangular, much wider than long, with a narrow, triangular, rugulose median depression, widest and deepest anteriorly; hind margin straight, at each square corner with a short row of finger-shaped protuberances each bearing a tuft of soft setulae (Figs. 78*D-E*). Metathoracic pleurotergite low, transverse, slightly convex, without differentiated process. Sternum flatter than usual, with deep furcal pits; prosternum divided into two broad lobes by a median concavity (as in some *Lynchia*); outer (side) margin of meta-basisternum produced as a tooth (metasternal spur) over base of hind coxa (as normally in all *Stilbometopa* and in a few species of *Lynchia*); hind margin of meta-furcasternum slightly emarginate, each side forming a short, broad lobe; longitudinal median sternal suture as in *Lynchia*, lacking over meta-furcasternum. Prothoracic and metathoracic spiracles as in *Lynchia*. Legs and claws (Fig. 78*I*) as in *Lynchia*. Wing (Figs. 79*A*, 80, 81*E* and 82) large, with the venation more reduced than in *Lynchia*, both posterior basal and anterior basal cross-veins lacking; anal cell combined with 3rd posterior and axillary cells; 2nd basal cell fused with 2nd posterior cell; as in *Lynchia* and *Micro-*

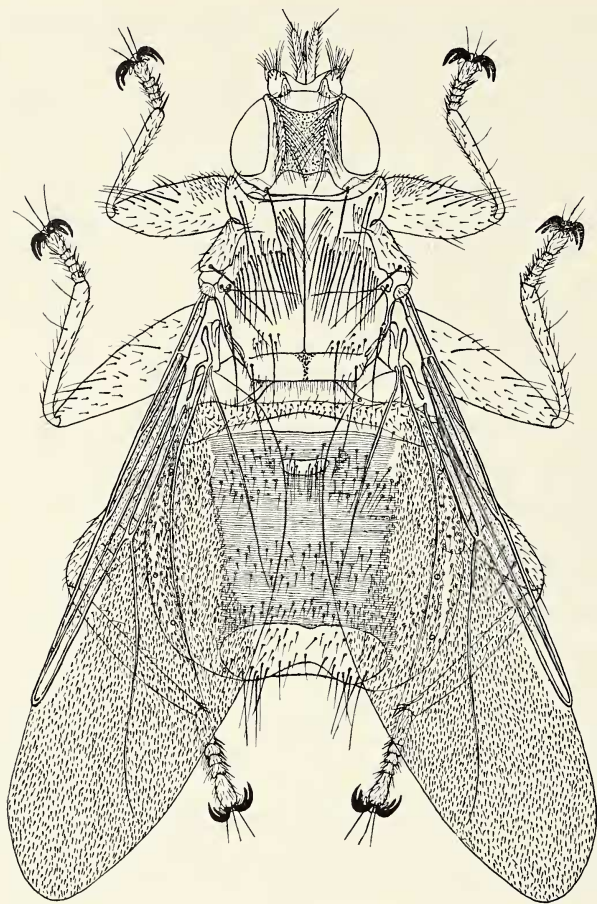


Fig. 77. *Pseudolynchia canariensis* (Macquart). ♀, Djakarta, Java, on domestic pigeon. $\times$ about 13.

lynchia, 6th longitudinal vein reduced to a short, weak, mostly discolored stump; axillary vein well developed, followed by a broad postaxillary cell in which a longitudinal crease often simulates a spurious vein; subcosta usually complete, ending in costa; 2nd longitudinal vein approaching the costa about mid-way between tips of 1st and 3rd longitudinals and then gradually fusing with it; membrane extensively covered with microtrichia; alula rudimentary, reduced to a very narrow membrane, somewhat wider toward apex; calypteres as in *Lynchia*. Abdomen (Figs. 78F-G and 81A and D) as in *Lynchia*: dorsally with an extensive, nearly bare,

densely and finely striolate median area, in which a small median sclerite is differentiated in both sexes behind the fused basal laterotergites; in the ♂ in addition with a posterior pair of small sclerites basad of the large, transverse preapical tergite. Abdominal spiracles as in *Lynchia*. Body more densely setulose than usual, particularly on inner orbits (always with several rows of bristles) and on antero-lateral areas of prescutum; normally one vertical bristle (exceptionally 2 as an abnormality). Scutellum with one long discal bristle near each corner, sometimes in a row of weak setulae, and an apical fringe of soft setulae continuing the tufted lateral digitations. Sternum with very few setae. Male terminalia (Fig. 79F) similar to those of *Lynchia*; the setigerous lobes at the sides of the genital atrium rather large.

Speiser's diagnosis of *Lynchia* (1902) covered strictly speaking only *Olfersia maura* Bigot (= *Olfersia canariensis* Macquart) and related species and synonyms (*lividicolor* Bigot; *capensis* Bigot; *exornata* Speiser; *garzettiae* Rondani; and *rufipes* Macquart). Only these agree with his description of the scutellum ("scutellum always strongly transversely truncate, nearly 4 times as wide as long") and of the venation ("remarkable and characteristic because of the entirely open 2nd basal cell, the anterior basal cross-vein being completely absent"). These peculiarities are not present in the other species included by Speiser, *Lynchia penelopes* Weyenbergh, the original monotype of *Lynchia*, and *Olfersia aenescens* Thomson, a species now properly placed in *Olfersia*. Because of this, *Pseudolynchia* was proposed for *Olfersia maura* and its allies, which Speiser had called *Lynchia* by error, as the type of *Lynchia* is not congeneric with them.

I recognize at present in *Pseudolynchia* 3 species only, which are very closely related: *P. canariensis* (Macquart, 1840), *P. brunnea* (Latreille, 1812), and *P. rufipes* (Macquart, 1848). *Pseudolynchia fradeorum* Tendeiro (1950, p. 127), recently described from Portuguese East Africa (Maputo, Lourenço Marques Distr., on *Bubo africanus*), I can only regard as a synonym of *P. rufipes*, a common parasite of African owls. *P. brunnea* is restricted to the New World. The other two species were originally endemic in the Old World, particularly in the tropical and subtropical areas; but *P. canariensis* has been spread by Man with domestic pigeons to nearly all parts of the world.

Although differing only in minor characters, the 3 species of *Pseudolynchia* show the usual lack of correlation between the affinities of the parasites and those of their hosts. *P. brunnea* is strictly

specific of Caprimulgiformes. *P. canariensis* is chiefly a parasite of wild and domestic Columbiformes; but in its original Old World habitat it also uses as breeding hosts certain Falconiformes and possibly even Cuculiformes. The inadequate information now available for *P. rufipes* tends to show that its normal or, at any rate, preferred breeding hosts are Strigiformes and Caprimulgiformes; but it is interesting that it is not restricted to the Caprimulgidae, like its American congener, *P. brunnea*.

The bionomics of few other Hippoboscidae have been as thoroughly investigated as those of *P. canariensis*, owing to its economic importance as a pest and as the vector of a malaria-like disease of domestic pigeons (Part I, pp. 354-358). The puparium, known only for *P. canariensis*, is similar to that of *Lynchia*.

Key to American Species of *Pseudolynchia*

1. Wing with the combined anal, 3rd posterior and axillary cells almost wholly covered with microtrichia; only postaxillary cell bare. Interocular face about twice as wide as an eye. Wing 4.8 to 6 mm. long *P. brunnea*
- Wing with the posterior area of the combined anal, 3rd posterior and axillary cells, as well as the postaxillary cell, bare. Interocular face less than twice as wide as an eye. Wing 4.5 to 7.5 mm. long *P. canariensis*

Pseudolynchia canariensis (Macquart)

Figs. 6A-C, 7A-D, 11F, 13E, 77, 78A-I, 79A-H and 80

- Olfersia canariensis* Macquart, 1840, in Webb and Berthelot, Hist. Nat. Iles Canaries, 2, pt. 2, Entomologie, p. 119 ("♀"; no host. Canary Islands. Type ♂ [not ♀] at Paris Mus.); 1843, Mém. Soc. R. Sci. Agric. Arts Lille, (for 1842), p. 434 [1843, Dipt. Exot., 2, pt. 3, p. 277].⁵²
- Pseudolynchia canariensis* J. Bequaert, 1935, Rev. Zool. Bot. Afric., 27, pp. 396 and 397, figs. 1D-E; 1938, Ent. News, 49, p. 42; 1939, Science, 89, p. 268. Herms, 1939, Medical Entomology, 3rd Ed., p. 379. J. Bequaert, 1940, Mem. Soc. Cubana Hist. Nat., 14, No. 4, p. 324; 1940, Rev. Acad. Colombiana Cienc. Ex. Fis. Nat., 3, No. 12, p. 416. Levi, 1941, The Pigeon, pp. 292, 318, and 319, fig. (also in 2nd Ed., 1945; South Carolina: first observed in 1915). Kadner, 1941, Science, 93, p. 281 (Southern California). Bunyea and Wehr, 1941, U.S. Dept. Agric., Farmers' Bull. No. 1652 (revised), pp. 56 and 82. Wolcott, 1941, Jl. Agric. Univ.

⁵² The pigeon-fly was first mentioned in print by Bernardin de St. Pierre (1773, Voyage à l'Isle de France, à l'Isle de Bourbon, au Cap de Bonne-Espérance, 1, p. 134). He wrote from Port-Louis, Mauritius: "Je n'oublierai pas un pou fort singulier que j'ai vu s'attacher aux pigeons. Il ressemble au ticq de nos bois, mais la nature lui a donné des ailes. Celui-là est bien destiné aux oiseaux."

Puerto Rico, 25, pt. 2, p. 121. Bishopp, 1942, U.S. Dept. Agric. Yearbook for 1942, "Keeping Livestock Healthy," pp. 1072-1074, figs. 1-2 (adult; puparium). Essig, 1942, College Entomology, p. 815. J. Bequaert, 1942, Bol. Entom. Venezolana, 1, No. 4, p. 82; 1943, Bull. Brooklyn Ent. Soc., 37, (for 1942), pt. 5, p. 185; 1943, Jl. of Parasitology, 29, p. 131. Hathaway, 1943, Mem. Inst. Osw. Cruz, 38, pt. 3, p. 413, figs. 1-2 (Brazil: Rio de Janeiro, on domestic pigeon, with 7 Mallophaga, *Columbicola columbae*, carried by 1 fly). Iriarte, 1943, Bol. Lab. Clínica L. Razetti, Caracas, 4, No. 11, p. 195 (Venezuela: State of Guárico). Barger and Card, 1943, Diseases Parasites Poultry, 3rd Ed., p. 366. (Anonymous), 1943, U.S. Dept. Agric., Insects in Relation to National Defense, Circ. 19, p. 22, figs. 5-6 (adult, puparium). Benbrook, 1943, in Biester and Devries, Diseases of Poultry, 1st Ed., p. 614, fig. 169. McIndoo, 1943, U.S. Dept. Agric., Bur. Ent. Plant Quar., E-597, (mimeographed), p. 16. Snodgrass, 1943, Smithsonian. Misc. Coll., 104, No. 1, p. 46, figs. 17D, E, F and I (mouth-parts); 1944, *Op. cit.*, 104, No. 7, pp. 79 and 80; figs. 31D, E, F, I. Renjifo, 1944, Notas Entomológicas Regionales, p. 24 (Colombia; Buga, Dept. del Valle, on domestic pigeon). Roark, 1945, U.S. Dept. Agric., Bur. Ent. Plant Quar., E-652, (mimeographed), p. 27. Herman, 1945, California Fish Game, 31, pp. 22 and 23.⁵³ Benbrook, 1945, List Parasites Domesticated Animals North America, 1st Ed., p. 35 (also in 2nd Ed., 1946; and 3rd Ed., 1948). Ditmans, 1945, Amer. Jl. Vet. Res., 6, p. 239. Roveda and Ringuelet, 1947, Gaceta Veter., Buenos Aires, 9, No. 46, p. 78 (Argentina). Anduze, Pifano and Vogelsang, 1947, Bol. Entom. Venezolana, Num. Extra, p. 6. Mönnig, 1947, Veterinary Helminthology Entomology, 3rd Ed., p. 347, fig. 239. Reyes, 1947, Rev. Gracolonbiana Zoot. Hig. Med. Vet., 1, Nos. 10-12, p. 706 (Colombia); 1948, Rev. Med. Veter., Bogotá, 17, No. 96, p. 71 (Colombia). MacArthur, 1948, Bull. Publ. Mus. Milwaukee, 8, pt. 4, pp. 426 and 429, fig. 255 (Iowa: Ames. Wisconsin: Madison, Dane Co.; New Holstein. Illinois: Chicago. All on domestic pigeon). Ringuelet, 1948, Publ. Misc. Min. Agric. Argentina, No. 281, pp. 40 and 54 (Argentina: Cnel. Arnold, Santa Fé; Capital Federal; San Pedro, Buenos Aires; all on domestic pigeon). Benbrook, 1948, in Biester and Schwarte, Diseases of Poultry, 2nd Ed., p. 732, fig. 31.9. Greene, 1949, American Racing Pigeon, 65, No. 7, p. 9. Hughes, 1949, U.S. Publ. Health Repts., Suppl. 210, p. 32 (on aircraft). Barger and Card, 1949, Diseases Parasites Poultry, 4th Ed., p. 366, fig. 77. Thompson, 1949, Ent. Mo. Mag., 85, p. 248 (Jamaica: Long Mountain, St. Andrew, on domestic pigeon). Traversi, 1949, Pampa Argentina, Buenos Aires, 23, No. 262, p. 24, figs. Rendtorff, Jones and Coatney, 1949, Trans. R. Soc. Trop. Med. Hyg., 43, No. 1, p. 7 (transmission of *Haemoproteus columbae*). Wray, 1950, Insects North Carolina, 2nd Suppl., p. 33 (North Carolina: Raleigh). Herms, 1950, Medical Entomology, 4th Ed., p. 413. Lastra and Coatney, 1950, Jl. Nation. Malar. Soc., 9, pt. 2, p. 151 (experiments with *Haemoproteus columbae*). J. Bequaert, 1951, Bull. Brooklyn Ent. Soc., 46, p. 49 (on aircraft). Wolecott, 1951, Jl. Agric. Univ. Puerto Rico, 32, (for 1948), pt. 3, p. 531 (Puerto Rico: Yabucoa). Peterson, 1951, Larvae of Insects, 2, p. 260. Dikmans, Foster, Stein and Giltner, 1952, U.S. Dept. Agric., Yearbook for 1952, "Insects," p. 164. Martini, 1952, Lehrbuch d. Medizinischen Entomologie, 4th Ed., p. 278, fig. 187 (as *P. maura*). Benbrook, 1952, List Parasites Domesticated Animals North America, Revised Ed., p. 52. Coatney and Hickman, 1952, Jl. of Parasitology,

⁵³ The host of the mites mentioned on p. 23 was *Microlynchia pusilla*, not *P. canariensis* as stated.

- 38, No. 4, Sect. 2, p. 12 (transmission of *Haemoproteus columbae*). Ward, 1953, Bull. Brooklyn Ent. Soc., 48, p. 128 (Illinois: Chicago. Phoresy of *Columbicola columbae*). Woke, Jacobs, Jones and Melton, 1953, Jl. of Parasitology, 39, pp. 525 and 531 (negative transmission experiments with *Toxoplasma gondii*). Schuurmans Stekhoven, 1954, Entom. Ber. Nederl. Entom. Ver., 15, pt. 2, pp. 24-25 (Argentina: Tucumán. Bionomics). Schuurmans Stekhoven, Silva, and San Roman, 1954, Zeitschr. f. Parasitenk., 16, pp. 388-406, fig. 1 (bionomics in Argentina).
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- Olfersia garzettæ* Rondani, 1879, Bull. Soc. Ent. Italiana, 11, p. 23 (no sex; no host. Italy: Insubria. Type in Natural History Museum at Florence, labelled as from northern Italy).
- Lynchia garzettæ* Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 155. Bezzi, 1905, Kat. Paläarkt. Dipt., 4, p. 276. Speiser, 1908, Zeitschr. Wiss. Insektenbiol., 4, pp. 244 and 245 (seen from Bavaria). Bau, 1929, Zoolog. Anzeiger, 85, p. 10 (Greece: Attica).
- Olfersia maura* Bigot, 1885, Ann. Soc. Ent. France, (6), 5, p. 237 (no sex; no host. Algeria. Two ♀ cotypes from Bigot Coll., now in J. E. Collin Coll.).
- Lynchia maura* Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 162 (type); 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 245. Bezzi, 1909, Broteria, Ser. Zoolog., 8, pt. 2, p. 64 (Brazil: São Paulo). Sureouf and Gonzalez-Rincones, 1912, Essai Diptères Vulnérants Vénézuëla, 2, p. 205 (Venezuela: Caracas, on domestic pigeon). Helen Adie, 1915, Indian Jl. Med. Res., 2, p. 672 (India: Ambala, on domestic pigeon, with Mallophagan attached. Digestive system; transmission of *Haemoproteus columbae*). Knab, 1916, Insecutor Inscitiae Menstruus, 4, p. 3 (in part: specimens on domestic pigeon. Florida: Key West. Georgia: Savannah, September, 1896. Cuba: Havana. Brazil: Ceará [specimen named "*brunnea*" for da Rocha by Coquillett]; São Paulo; Campinas. Also said to be common at Caracas, Venezuela.⁵⁴ Bodkin and Cleare, 1916, Bull. Ent. Res., 7, pt. 2, p. 187 (British Guiana: common on domestic pigeons). Newstead, 1918, Ann. Trop. Med. Paras., 12, p. 104, fig. 6 (puparium). Cleare, 1919, Brit. Guiana Med. Annual for 1919, 22nd Year, Demerara, p. 70. Austen, 1921, Bull. Ent. Res., 12, pt. 1, p. 122 (Jamaica: Spanish Town. Brazil: Pará). Barroso, 1922, Os Parasitas Vegetaes e Animaes, (Bahia), p. 163. Herms, 1923, Medical Veterinary Entomology, 2nd Ed., p. 351. Wolcott, 1924, Jl. Dept. Agric. Puerto Rico, 7, (for 1923), pt. 1, p. 234 (Puerto Rico). Root, 1925, 13th Ann. Rept. United Fruit Co., Med. Dept., (for 1924), p. 209 (Republic of Honduras: Puerto Arturo near Tela). Jobling, 1926, Parasitology, 18, pt. 3, p. 321, figs. IIA and IIA-B; Pl. 11, figs. 1-9; Pl. 12, figs. 21-26; Pl. 14, figs. 32-43 (anatomy of head, antenna and mouth-parts). Gowdey, 1926, Dept. Agric. Jamaica, Ent. Bull. 4, pts. 1-2, p. 90. Wolcott, 1927, Entomologie d'Haiti, p. 331. Ward and Gallagher, 1927, Diseases Domesticated Ani-

⁵⁴ The specimen from Ames, Iowa, referred by Knab to *L. maura* was *Pseudolynchia brunnea*.

mals, p. 213. de Beurepaire Aragão, 1927, C. R. Soc. Biol., Paris, 97, pp. 827-829 (transmission experiments with *Haemoproteus columbae* and *Trypanosoma hannaï* in Brazil). Barre, 1929, 42nd Ann. Rept. South Carolina Expt. Sta., p. 63 (South Carolina). Hegner, 1929, Animal Parasitology, p. 571, fig. 253. Bishopp, 1929, Jl. Econ. Entom., 18, pp. 974-980 (Florida: Lockhart. Georgia. South Carolina. North Carolina. Virginia. Maryland. District of Columbia. Alabama. Mississippi. Louisiana. Arkansas. Texas: Dallas. Kansas. Iowa. California. *Haemoproteus columbae* near Washington, D.C. Infested with mites in Florida). Aschner, 1931, Zeitschr. Morph. Oekol. Tiere, 20, pts. 2-3, pp. 371, 378-380, fig. 1; Pl. 1, fig. 8; Pl. 2, figs. 18-22 (symbionts). Zebrowski, 1932, Audubon Yearbook, Indiana Audubon Soc., p. 48 (also as *Pseudolynchia maura*). Wolcott, 1936, Jl. Agric. Univ. Puerto Rico, 20, pt. 1, p. 392 (Puerto Rico: Río Piedras: San German; Mayaguez; Coamo). Rivero and Ramirez, 1940, Rev. Inst. Salubr. Enferm. Tropic., Mexico, 1, p. 247. Neveu-Lemaire, 1943, Traité Protozoologie Médicale Vétérinaire, pp. 451 and 795, figs. 258, 259, and 454. Craig and Faust, 1951, Clinical Parasitology, 5th Ed., p. 722. Dikmans, Foster, Stein and Giltner, 1952, U.S. Dept. Agric., Yearbook for 1952, "Insects," p. 164. Riley and Wallace, 1952, Introduction Study Animal Parasites, 6th Ed., p. 77. Hall, 1953, Protozoology, p. 305, fig. 6.22 (*Haemoproteus columbae*). Reichenow, 1953, in Doflein, Lehrbuch d. Protozoenkunde, 6th Ed., pp. 893-895. Gonzales-Rincones and Guyon, 1953, Clasificación General de los Dípteros, p. 166, fig. 102. Vogelsang, 1953, Deutsch. Tierärztl. Wochenschr., 60, p. 530 (Venezuela).

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- tenna). Huff, 1942, JI. Infect. Dis., 71, p. 18 (*Haemoproteus columbae*). Maliandi, 1943, Rev. Med. Vet., Buenos Aires, (Year 28), 25, pts. 3-4, pp. 128, 131 (fig.), 132 (fig.) and 133 (fig.). de Sequeira, 1944, Chacaras e Quintais, 69, p. 357. Loria, 1944, Suelo Argentino, 3, p. 299; 1944, Almanaque Min. Agric. Nac. Argentina, 19, pp. 209-211. de Figueredo and Simões Barbosa, 1944, Anais Soc. Biol. Pernambuco, 5, pt. 1, pp. 15-16, figs. 1-4 (Brazil: Recife, State Pernambuco. Infestation with mites, *Myialges pseudolinchia*). Seiden, 1947, Poultry Handbook, pp. 281 and 283 (same in 2nd Ed., 1952). Becker, 1948, in Biester and Schwarte, Diseases of Poultry, 2nd Ed., p. 922. Cassamagnaghi, 1950, Bol. Mens. Dir. Ganadería, Uruguay, 31, pt. 3, p. 374, figs. 5-6 (Uruguay). Kaupp and Surface, 1950, Poultry Sanitation Disease Control, 4th Ed., p. 164. Hennig, 1952, Larvenformen der Dipteren, 3, pp. 401-402, fig. 301 (larval stigmal plates). Correa, 1952, Bol. Dir. Prod. Anim., Rio Grande do Sul, 8, No. 13, p. 6; Pl., fig. 3 (Brazil: Rio Grande do Sul).
- Olfersia lividicolor* Bigot, 1885, Ann. Soc. Ent. France, (6), 5, p. 238 (no sex; no host. Brazil. Type ♀ from Bigot Coll., now in J.E. Collin Coll.).
- Lynchia lividicolor* Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 164 (type); 1903, Centralbl. Bakt. Parasit., Abt. 1, Orig., 33, p. 610 (Brazil: on domestic pigeon); 1908, Zeitschr. Wiss. Insektenbiol., 4, p. 304 (said to be possibly identical with *maura* Bigot). Lutz, Neiva, and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, 7, pp. 185, 191 and 194; Pl. 27, fig. 10, Pl. 28, fig. 5 (Brazil: common on domestic pigeons). de Beaurepaire-Aragão, 1916, Brazil-Medico, 30, pp. 353 and 361 (transmission of *Haemoproteus columbae* in Brazil). Lutz and Nuñez-Továr, 1928, Estudios Zoológica Parasitología Venezolanas, p. 9 (Venezuela: on domestic pigeon). Vogelsang, 1936, Rev. de la Policlínica, Caracas, 6, No. 31, p. 2.123 (Venezuela: Maracay, on domestic pigeon). Carbonell, 1938, Parasitología en Venezuela y los Trabajos del Dr. M. Nuñez-Továr, p. 250. Neveu-Lemaire, 1938, Traité Entomologie Médicale Vétérinaire, p. 982; 1943, Traité Protozoologie Médicale Vétérinaire, pp. 451 and 795.
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- Pseudolynchia maura* var. *lividicolor* J. Bequaert, 1926, Psyche, 32, (for 1925), pt. 6, p. 274.
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- Lynchia brunea lividocolor* Patton and Cragg, 1913, Textbook Medical Entomology, p. 407 (Brazil).
- Lynchia lividicla* R. v. Ihering, 1940, Da vida dos Nossos Animais, Fauna do Brasil, 2nd Ed., p. 247, fig. 504 [1st Ed., 1917, not seen]; (error for *lividicolor*).
- Olfersia capensis* Bigot, 1885, Ann. Soc. Ent. France, (6), 5, p. 240 (♂; no host. South Africa: Cape of Good Hope. Type ♂ in J. E. Collin Coll.).
- Lynchia capensis* Speiser, 1902, Zeitschr. Syst. Hym. Dipt., 2, p. 166 (type, redescribed); 1908, Zeitschr. Wiss. Insektenbiol., 4, pp. 245 and 246 (seen from Canary Ids.). Ward and Gallagher, 1927, Diseases Domesticated Animals, p. 213. Neveu-Lemaire, 1943, Traité Protozoologie Médicale Vétérinaire, pp. 451 and 795.
- Pseudolynchia capensis* Root and Huff, 1938, Parasitology Man Domestic Animals, p. 614.
- Olfersia falcinelli* Bezzi and de Stefani-Perez, 1897, Naturalista Siciliano, (N. S.), 2, p. 71 (Sicily, on domestic pigeon). de Stefani-Perez, 1901, Boll.

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- Olfersia exornata* Speiser, 1900, Ann. Mus. Civ. Stor. Nat. Genova, **40**, p. 562 (no sex; no host. West Sumatra: Doloc Tolong. Type ♀ in Genoa Mus.).
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- Lynchia simillima* Speiser, 1904, Ann. Mus. Civ. Stor. Nat. Genova, **41**, p. 337 (no sex; no host. Java: based on the specimen called "*Olfersia spinifera*" by van der Wulp, 1880, Tijdschr. v. Entom., **23**, p. 193. Type from J.C.H. de Meijere Coll., now in the collection of the Nederlandsche Entom. Vereeniging, Amsterdam); 1908, Zeitschr. Wiss. Insektenbiol., **4**, p. 302.
- Lynchia brunnea* Coquillett, 1907, Ent. News, **18**, p. 290. Dias da Rocha, 1908, Bol. Museu Rocha, Ceará, **1**, pt. 1, p. 77 (Brazil: Ceará; specimen named "*brunnea*" by Coquillett, which I found to be *canariensis*). Essig, 1926, Insects Western North America, p. 623 (California: San Diego, on domestic pigeon). Not of Latreille, 1812.
- Pseudolynchia brunnea* Root and Huff, 1938, Parasitology Man Domestic Animals, p. 614. Not of Latreille, 1812.
- Lynchia brunnea* Mayo, 1909, 2nd Ann. Rept. Cuba Agric. Expt. Sta., p. 27 (Cuba: on domestic pigeon). Neveu-Lemaire, 1943, Traité Protozoologie Médicale Vétérinaire, pp. 451 and 795.
- Pseudolynchia mauza* Schuurmans Stekhoven, 1931, Lingnan Sci. Jl., **7**, (for 1929), p. 501 (error for *maura*).
- Pseudolynchia* or *Lynchia* sp. Rivero, 1947, Medicina, Mexico, **27**, pp. 197 and 199.
- Lynchia carolinensis* Reichenow, 1953, in Doflein, Lehrbuch d. Protozoenkunde, 6th Ed., p. 894 (error for *L. canariensis*).

The following references use only the vernacular name "pigeon-fly:" S.L.R., 1922, Amer. Pigeon Jl., **11**, p. 335 (Panama: common on domestic pigeon in Canal Zone). Gilbert, 1922, *Op. cit.*, **11**, p. 383 (Florida: Jacksonville). Houbich, 1922, *Op. cit.*, **11**, p. 383 (Panama: France Field, C.Z.). Bishopp, 1929, *Op. cit.*, **18**, p. 517 (methods of control). Fung, 1930, *Op. cit.*, **19**, p. 259 (control). Levi, 1930, *Op. cit.*, **19**, pp. 270 and 319 (control). Haynes, 1944, Practical Pigeon Production, p. 211. Levi, 1946, Making Pigeons Pay, p. 224.⁵⁵

Distribution and Specimens Examined. UNITED STATES. ALABAMA (recorded by Bishopp, 1929): Birmingham, Jefferson Co. (J.M. Lowrey); Montgomery, Montgomery Co. (M.J. Myers); Auburn, Lee Co. (A.O. Haugen). — ARKANSAS (recorded by Bishopp, 1929): Little Rock, Pulaski Co. (W.J. Baerg). — CALIFORNIA (recorded by Essig, 1926; Bishopp, 1929; Kadner, 1941):

⁵⁵ Vogl, 1944, Bol. Soc. Venezolana Cienc. Natur., **9**, No. 60, p. 323, lists several localities in Venezuela where he supposedly collected "*Lynchia lividicola*," in the feathers of Falconidae, Vulturidae, Strigidae, "sobre huevos de zamuros," and some aquatic birds. As several distinct species of Hippoboscidae were evidently confused, it is impossible to use the records.

San Bernardino Co. (C. Meith); Compton, Los Angeles Co. (T. Leuder); Tarzana, Los Angeles Co. (A.M. Hill); Westwood Hills, Los Angeles Co. (R.S. Pence); Los Angeles (J. Posell; B. Turner); Loma Linda, San Bernardino Co. (R.E. Ryckman, *et al.*); San Diego, San Diego Co. (E.O. Essig); Santa Ana, Orange Co. (J. Shanafelt); Oxnard, Ventura Co. (Calif. Dept. Agric.); Point Loma, San Diego Co. (F.C. Bishopp). — COLORADO: Denver, Denver Co. (F.R. Dutton). — CONNECTICUT: Stamford, Fairfield Co. (Grierson and van Dusen). — DELAWARE: Newark, New Castle Co. (D. MacCreary). — DISTRICT OF COLUMBIA (recorded by Bishopp, 1929): seen (F.C. Bishopp). — FLORIDA (recorded by Knab, 1916; Gilbert, 1922; Bishopp, 1929): Monticello, Jefferson Co. (F.W. Walker); Gainesville, Alachua Co. (T.J. Cantrall); Jacksonville, Duval Co. (E.C. Cushing; K.W. MacArthur; E. Basham); Delray Beach, Palm Beach Co. (C.W. Johnson; C.G. Huff); Miami, Dade Co. (J.M. Brian), and 5 flies intercepted on 4 planes arriving from Brazil, Trinidad and India (W.W. Wirth. — See J. Bequaert, 1951b); Longwood, Seminole Co. (W.L.G. Bruce); Lockart, Orange Co. (F.C. Bishopp); Homestead, Dade Co.; Pensacola, Escambia Co. (F.C. Bishopp); Key West, Monroe Co. (J.Y. Porter); Orlando, Orange Co. (W.W. Yothers); Larkins, Dade Co. (S. Graenicher). — GEORGIA (recorded by Knab, 1916; Bishopp, 1929): [Perry, Houston Co.; Augusta, Richmond Co. — P.W. Fattig, *in litt.*; not seen]; Savannah, Chatham Co. (W. Duncan); Atlanta, Fulton Co. (P.W. Fattig; J. R. Harber; L. Brown); Bainbridge, Decatur Co., on poultry (R.H. Herron); Macon, Bibb Co. (F.C. Bishopp). — ILLINOIS (recorded by MacArthur, 1948; Ward, 1953): Chicago (A.K. Wyatt). — IOWA (recorded by Bishopp, 1929; Drake and Jones, 1930; Coatney, 1933; MacArthur, 1948): Ames, Story Co. (T.M. Harris); Des Moines, Polk Co.⁵⁶ — KANSAS (recorded by Bishopp, 1929): Arkansas City, Cowley Co. (G.C. Abelson). — LOUISIANA (recorded by Bishopp, 1929): Luteher, St. James Parish (Cox. — Received from E.B. Johnson); Houma, Terrebonne Parish (W.A. Douglas); Lafayette, Lafayette Parish (C. Gary); Baton Rouge, East Baton Rouge Parish (F.C. Bishopp; W.W. Wirth; J.H. Roberts); New Orleans (T.E. Snyder). — MARYLAND (recorded by Bishopp, 1929): Bethesda, Montgomery Co., at Trop. Dis. Lab. (P.A. Woke). — MASSACHUSETTS: Cambridge, Middlesex Co., Oct. 1932, Dec. 1941, and June 1942 (R.P. Dow; D.R. Griffin and

⁵⁶ The fly recorded by Knab (1916) from Iowa as "*Lynchia maura*" was *P. brunnea*, according to the specimen; but I have seen true *P. canariensis* from Ames and Des Moines.

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G. Bartholomew); Boston, about 1940 (D.L. Augustine), Dec 21, 1952, one ♀ flying from a dead feral pigeon onto a person (received from G.E. Wallace), and May 6, 1954, on a pigeon kept in a laboratory (A.G. Humes). — MISSISSIPPI (recorded by Bishopp, 1929): Jackson, Hinds Co. (Mrs. J.V. Bogert); Hattiesburg, Forrest Co. (E. Cook); Macon, Noxubee Co. (J.V. Pace); McComb, Pike Co. (D.M. Williams); Terry, Hinds Co. (O.M. Chance); Laurel, Jones Co. (C.G. Wallace); Meridian, Lauderdale Co. (F. Ziller); Natchez, Adams Co. (F.C. Bishopp). — NEVADA: Las Vegas, Clark Co. (W.B. Low). — NEW JERSEY (recorded by Beaudette, 1932): Bloomfield, Essex Co. (J.N. Belkin). — NEW YORK: New York City, Oct. 1922 (J. Bequaert), and Sept. 1951 (J.W.H. Rehn). — NORTH CAROLINA (recorded by Bishopp, 1929; Wray, 1950): Raleigh, Wake Co. (R.M. Brown; Mrs. R.C. Simpson). — PENNSYLVANIA: Pittsburgh, several adults in a pigeon loft, Oct. 1948 (G.E. Wallace). — SOUTH CAROLINA (recorded by Barre, 1929; Bishopp, 1929; Coatney, 1931): Columbia, Richland Co.; Sumter, Sumter Co. (H. Moise; E.E. Wehr); Charleston, Charleston Co. (J.T. Rogers). — TENNESSEE: Nashville, Davidson Co., July 18, 1955, on feral domestic pigeon (Mrs. A.R. Laskey); Knoxville, Knox Co. (A.C. Cole). — TEXAS (recorded by Bishopp, 1929; Martin, 1934): San Antonio, Bexar Co. (B. Weir); Houston (C.P. Coogle); Corpus Christi, Nueces Co. (W.M. Gordon); Port Arthur, Jefferson Co. (J. Johnston); Santa Anna, Coleman Co. (O.R. Brown); Dallas, Dallas Co. (F.C. Bishopp). — VIRGINIA (recorded by Bishopp, 1929): Cape Henry, Princess Anne Co. (E.A. Chapin). — WISCONSIN (recorded by MacArthur, 1948): Madison, Dane Co. (F. Snyder).

MEXICO: [Chapultepec, D.F., on domestic pigeon. — Mrs. Ana María de Buen de Biagi, *in litt.*, Aug. 30, 1950; not seen]; Mexico City, D.F. (G. Lasmann; Esc.N.C.Biol.); Tampico, State Tamaulipas (W. Garza).

REPUBLIC OF HONDURAS (recorded by Root, 1925): Puerto Arturo near Tela (F.M. Root).

COSTA RICA: San José (H. Schmidt).

PANAMA (recorded by S.L.R., 1922; Houbrich, 1922): Ancon, C.Z. (L.H. Dunn).

ANTILLES. CUBA (recorded by Mayo, 1909; Knab, 1916): Punta de Guano, Prov. Matanzas (F. Bermudez); Vedado, Havana (J.R. Taylor); Matanzas, Prov. Matanzas (C. Sanchez); Baragua, Prov. Oriente (L.C. Scaramuzza); San Antonio de los Baños, Prov. Havana (P. Cardin); Cienfuegos, Prov. Las Villas (P. Cardin). — JAMAICA (recorded by Austen, 1921; Gowdey, 1926; Thompson,

1949) : Kingston (W. Buthner; R.P. Bengry). — HISPANIOLA : Port-au-Prince, Haiti (C. Lhérisson; R.C. Smith.) — PUERTO RICO (recorded by Wolcott, 1924, 1936, 1951) : Yabucoa (L. Martorell) ; Mayagüez (H.L. Dozier; H.L. Van Volkenberg). — ST. CROIX : seen from domestic pigeon (H.A. Beatty).⁵⁷ — ST. KITTS : (Branch). — BARBADOS (G.S. Evelyn).

COLOMBIA (recorded by Renjifo, 1944; Reyes, 1947, 1948) : Bogotá (E. Osorno) ; Baranquilla, Dept. Atlantico (E. Osorno) ; Cali, Dept. Valle del Cauca (S. Renjifo-Salcedo) ; Palmira, Dept. Valle del Cauca (Newball) ; Cartagena (A. Paz Arriaga).

VENEZUELA (recorded by Surcouf and Gonzalez-Rincones, 1912, as *L. maura* ; Knab, 1916, as *L. maura* ; Lutz and Nuñez-Továr, 1928, as *L. lividicolor* ; Vogelsang, 1936, as *L. lividicolor*, 1953, as *L. maura* ; Martorell, 1939, as *L. maura* var. *lividicolor* ; Iriarte, 1943) : Hacienda Tazon near Caracas (D.R. Iriarte).

TRINIDAD : Port of Spain (R.C. Shannon).

BRITISH GUIANA (recorded by Bodkin and Cleare, 1916, as *L. maura*) : without precise locality (A.A. Abraham) ; Georgetown (J. Rodway).

BRAZIL (recorded by Bigot, 1885, as *L. lividicolor* ; Speiser, 1903, as *L. lividicolor* ; Aragão, 1907, as *L. brunea* or *L. lividicolor* ; Dias da Rocha, 1908, as *L. brunnea* ; Bezzi, 1909, as *L. maura* ; Lutz, Neiva and da Costa Lima, 1915, as *L. lividicolor* ; Knab, 1916, as *L. maura* ; Austen, 1921, as *L. maura* ; Pinto, 1938, as *P. maura* ; Hathaway, 1943 ; de Figueredo and Simões Barbosa, 1944, as *P. maura* ; Corrêa, 1952, as *P. maura*) : Rio de Janeiro, D.F. (L.C. Ferreira) ; Itaquaquecetuba, State São Paulo (C.H.T. Townsend) ; City of São Paulo (Ad. Lutz) ; Manáos, State Amazonas (J. Bequaert) ; Ypiranga, State São Paulo (J. Lane) ; Manguinhos, Rio de Janeiro, D.F. (Inst.Osw.Cruz) ; Vicosa, State Minas Gerais ; Ceará (F. Dias da Rocha) ; Campinas, State São Paulo (A. Hempel ; G. Bouvier) ; Kilom. 47 on road of Rio de Janeiro to São Paulo (C.H.T. Townsend).

PERU : Trujillo (J. Ormea).

URUGUAY (recorded by Cassamagnaghi, 1950) : Montevideo (Parker ; L.P. Barattini).

⁵⁷ The flies reported as *P. canariensis* from St. Croix, on a wild pigeon (*Colombigallina passerina brevirostris*, by H.A. Beatty (1947, p. 154), were misidentified *Microlynchia pusilla*. I have seen the specimens caught by Beatty on this host, at the U. S. National Museum, where they had been placed by error under *P. canariensis*.

ARGENTINA (recorded by Lagos and Canevari, 1937; Roveda and Ringuelet, 1947; Ringuelet, 1948; Schuurmans Stekhoven, 1954; Schuurmans Stekhoven, Silva and San Ramon, 1954): Tucumán (R. Golbach).

Unless expressly stated otherwise, the American records are from introduced domestic or rock pigeon, *Columba l. livia*. The fly is known to occur, at least during the summer, on pigeons gone feral in the United States at Boston, Cambridge, Mass., New York, Chicago and Nashville, and in Argentina at Tucumán. It probably does so in many other American cities.

P. canariensis was originally a native of the tropical and sub-tropical parts of the Old World, where it breeds regularly on several wild species of Columbidae and possibly also on some other types of birds. It is particularly widespread in Africa, the countries bordering the Mediterranean to the north, southern Asia and Indonesia. Farther north in Europe it is only accidental on wild hosts and does not occur regularly on domestic pigeons. In the Old World it is definitely known as a parasite of domestic pigeon in Portugal, Spain, southern France (Lyons), Italy, Sicily, Greece, Roumania, the Canary Islands, Morocco, Algeria, Tunis, Cyrenaica, Egypt, Senegal, the central Sahara (Hoggar), the eastern Sudan, Eritrea, Portuguese Guinea, Dahomey, French Congo, Belgian Congo, Ruanda-Urundi, Tanganyika, Zanzibar I., Somaliland, Eritrea, Northern Rhodesia, Southern Rhodesia, Nyasaland, South West Africa, Cape Province, Transvaal, Natal, Madagascar, Reunion, Mauritius, Seychelles, Cyprus, Palestine, Iraq, Arabia, India, Ceylon, southern China (Canton; Honan I.), Philippines, Sumatra, Java, Australia, Tasmania, and Hawaii. In addition there are records on wild hosts from France, Morocco, Liberia, Northern Nigeria, eastern Sudan, Arabia, Tanganyika, Uganda, Northern Rhodesia, Southern Rhodesia, Nyasaland, Cape Province, Cyprus, Afghanistan, India, Nepal, Thailand (Siam), Philippines, and southern Japan (Okinawa). The occurrences on wild hosts probably delimit the original home or autochthonous habitat of the species. The northmost records are from France: Paris, in the Jardin des Plantes, host unknown; Ushant I., about 48° 28' N., on turtle dove, *Streptopelia t. turtur*; Vitry-sur-Seine, about 48° 49' N., on domestic pigeon (Villeneuve, 1913, p. 131); and Moret, Dept. Seine-et-Marne, about 48° 22' N., on domestic pigeon (Séguy, 1932a). Speiser (1908) reported a specimen from Bavaria.

In the New World *P. canariensis* appears to be a comparatively recent arrival. It was first reported in 1885, when Bigot described

his *Olfersia lividicolor* (a synonym of *canariensis*) from Brazil; but it may have occurred in America many years before it was noticed by entomologists. The earliest reported occurrence in North America was from Savannah, Georgia, in 1896 (Knab, 1916). No specimen has been taken as yet in the Dominion of Canada. In the United States it occurs occasionally as far north as Ames, Chicago, Madison and Boston, all localities in about the same latitude (42° to 43° N.); therefore not as far north as in Western Europe. Moreover, it is doubtful whether it can survive severe winters north of Maryland and Kansas (J. Bequaert, 1943b). It is now reported from most of the Antilles, Central and South America, with the exceptions of Guatemala, San Salvador, Nicaragua, Dutch Guiana, French Guiana, Bolivia, Paraguay and Chile, where no doubt it will be found when looked for. The southmost localities known are Tucumán ($26^{\circ} 50'$ S.), where it is common, and Montevideo ($34^{\circ} 55'$ S.).

Bionomics. In the New World *P. canariensis* is strictly a parasite of domestic pigeons. There is no reliable evidence that it ever strays to any native American bird in nature; but there is one record from domestic poultry in Georgia. Coatney (1931) kept it alive for 15 days on domestic chickens, obtaining meanwhile normal puparia which produced adult flies. Coatney (1931, 1933) and Huff (1932) also induced the fly to bite and feed on native doves, *Zenaidura macroura carolinensis*, in the laboratory. It flies often onto Man and will bite him sometimes spontaneously.

In the Old World the fly has been taken in nature on the following wild hosts. Ciconiiformes: *Hagedashia hagedash niloticus*. Falconiformes: *Accipiter badius dussumieri*; *A. n. nisus*; *A. nisus nisosimilis*; *Aquila rapax raptor*; *Buteo v. vulpinus*; *Circætus g. gallicus*; *Circus macrourus*; *Falco amurensis*; *F. ardosiaceus*; *F. biarmicus erlangeri*; *F. eleonoræ*; *F. t. tinnunculus*; *Gymnogenys t. typicus*; *Haliaeetus v. vocifer*; *Kaupifalco m. monogrammicus*; *Lophaetus occipitalis*; *Meliæra gabar*; *M. m. musicus*; *M. musicus theresæ*; *Milvus migrans parasitus*; *Neophron percnopterus ginnianus*; *Polihæra s. semitorquatus*; *Spizaetus c. cirratus*. Galliformes: *Numida m. meleagris*; *N. meleagris somaliensis*; *Pternistis afer nyanzae*; *P. l. leucoscepus*. Columbiformes: *Columba livia intermedia*; *C. p. palumbus*; *C. rupestris turkestanica*; *Pterocles lichtensteini arabicus*; *P. q. quadricinctus*; *P. quadricinctus lowei*; *Streptopelia bitorquata dussumieri*; *S. capicola tropica*; *S. chinensis tigrina*; *S. d. decaocto*; *S. decipiens permista*; *S. r. roseogrisea*; *S. semitorquata erythrophrys*; *S. t. turtur*; *Treron calva schalowi*;

Turtur a. afer. Cuculiformes: *Clamator cafer*; *Crinifer africanus zonurus*; *C. leucogaster*; *C. personatus leopoldi*; *Cuculus c. canorus*. Strigiformes: *Asio c. capensis*; *Athene b. brama*; *Bubo b. bubo*; *Ketupa z. zeylonensis*; *Otus l. leucotis*; *Tyto alba affinis*. Coraciiformes: *Coracias g. garrulus*; *C. n. noevia*; *C. noevia mosambica*. Passeriformes: *Cinclus pallasii tenuirostris*; *Corvus albus*; *Galerida theklae ellioti*; *Temenuchus pagodarum*.⁵⁸ Although this is a long list, it is based on too few individual verified records for a full understanding of the relations of the fly with its wild hosts in nature. It is evident that various wild Columbidae are effective breeding hosts, so that the parasite of the domestic pigeon was obviously retained from the wild stock of the rock dove, *Columba livia* (Part I, p. 296). Whether or not the species could maintain itself on diurnal birds of prey, in the absence of Columbidae, remains, however, a moot question, in spite of its frequent occurrence on such birds. It should be kept in mind that many Raptores prey regularly on wild and domestic pigeons, from which they no doubt often acquire pigeon-flies, but perhaps only for a short time. The few occurrences on birds of other orders are probably all due to accidental or temporary straying.

I reviewed in Part I most of the available information on symbiotic micro-organisms (pp. 101 and 103), destruction by the host (p. 129), transmission of *Haemoproteus* to pigeons (pp. 138–139 and 354–358), parasitism by mites (pp. 145–146 and 158–159) and chalcids (p. 161), phoresy of Mallophaga (p. 173), sex ratio (p. 178), maturation period (p. 180), mating (pp. 182–183), larviposition (pp. 193–194), duration of pupal development (p. 199), adult longevity (pp. 203–204), rate of reproduction (pp. 207–208), population dynamics (p. 233), settling of new hosts (pp. 244–245), host specificity in domestication and in nature (pp. 295–296 and 323), and effect of the bite on Man (p. 345). More recent observations on some of these topics are summarized presently.

Through the courtesy of Dr. J.H. Schuurmans Stekhoven, Jr., I was able to mention briefly in Part I the important observations made by him and his associates in Argentina. These have now been published in two papers, one by Schuurmans Stekhoven (1954a) and the other by Schuurmans Stekhoven, Silva and San

⁵⁸ *Caprimulgus europaeus* is omitted from this host list, because the record of *Pseudolychnia maura* from this bird by Gil Collado (1937, p. 2061; 1947, p. 220), at Teruel, Spain, may have been due to failure to recognize *P. rufipes*, which I have seen from this host.

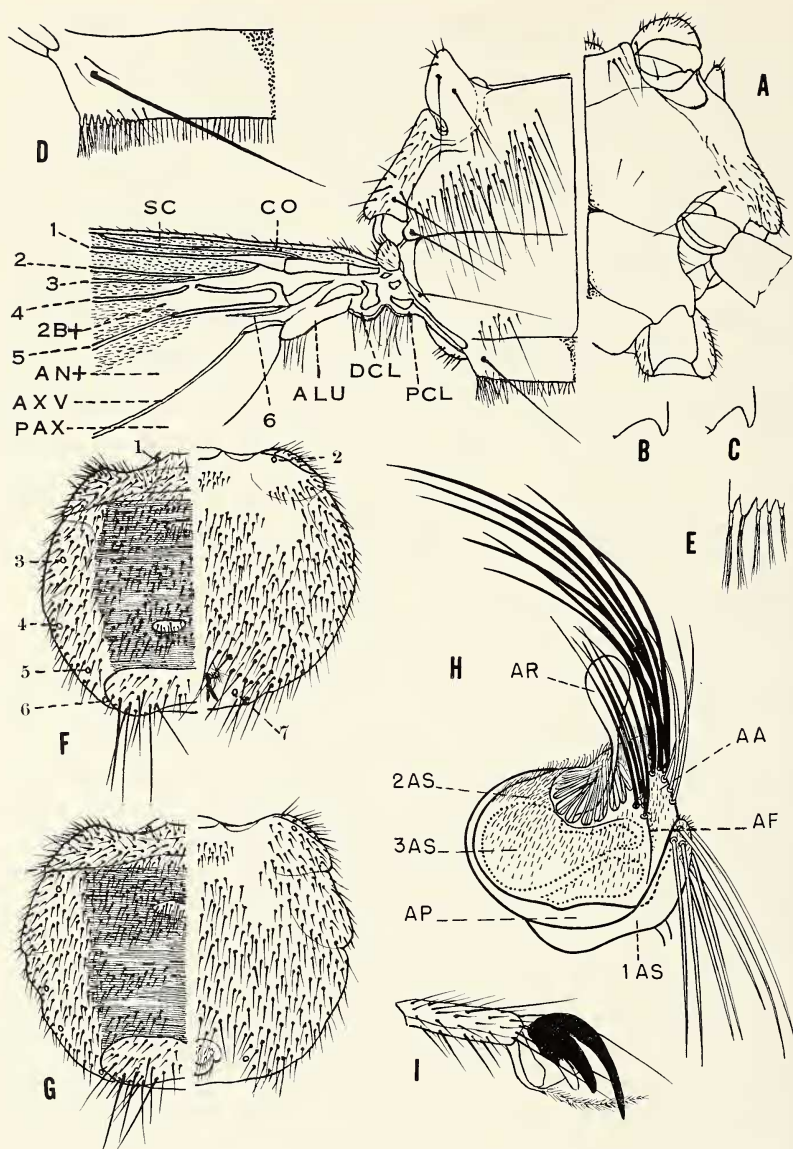


Fig. 78. *Pseudolynchia canariensis* (Macquart). A, thorax dorsally and ventrally, and basal area of left wing, ♀, Nashville, Tenn.: ALU, alula; AN+, combined anal, 3rd posterior and axillary cells; AXV, axillary vein; 2B+, combined 2nd basal and 2nd posterior cells; CO, costa; DCL, upper calyp-

Ramon (1954); a third paper is to appear shortly. These should be consulted for many additional details. The second paper covers the density and frequency of infestation on adult pigeons and on squabs in the nest (pp. 390-391), the sex ratio of flies found on pigeons and bred from puparia (pp. 394-395), the resistance to starvation of adult flies (pp. 396-399), the feeding behavior (pp. 400-403), and parasitism by mites and by chalcids (p. 404).

According to the latest information available, the correct name of the chalcid parasite, bred at Tucumán from puparia of *P. canariensis*, is *Nasonia vitripennis* (Walker) (synonyms: *Pteromalus vitripennis* Walker, 1836; *Pteromalus abnormis* Boheman, 1858; *Mormoniella brevicornis* Ashmead, 1904; *Nasonia brevicornis* Ashmead, 1904), and not *Mormoniella vitripennis* as given in Part I (p. 161). *Mormoniella* and *Nasonia* are synonyms, being based on the same species. Although *Mormoniella* has page precedence, *Nasonia* should be used, as it was preferred by the first reviser. (See Peck, 1951, in Muesebeck *et al.*, Hymenoptera of America North of Mexico, Synoptic Catalog, U.S. Dept. Agric., Agric. Monogr. No. 2, p. 559).

The following cases of infestation with mites may be added to the list:

9. Of 6 flies from domestic pigeon at Gainesville, Fla., 2 ♀ carried mite clusters on the sides of the dorsum of the abdomen, 3 in one case, 1 in the other.

10. A ♀ from Tampico, Mexico, on domestic pigeon, carried a small mite cluster dorsally on each side of the abdomen.

Concerning the mites of the pigeon-fly, it may be noted that both the generic and trivial names of *Myialges anchora* should be credited to Trouessart only, and not to Sergeant and Trouessart, as was done in Part I. Trouessart alone first published them with a brief diagnosis of the mite in 1906 (date given on the wrapper of pt. 5 of vol. 31 of *Bull. Soc. Zool. France*, where the description is on pp. 128-129) or early in 1907. Attention is also called to a recent discussion of *Myialges* by Furman and Tarshis (1953).

ter; *PAX*, postaxillary cell; *PCL*, lower calypter; *SC*, subcosta; 1, 2, 3, 4, 5, and 6, 1st, 2nd, 3rd, 4th, 5th, and 6th longitudinal veins; *B*, mesosternal spur, ♀, St. Kitts; *C*, mesosternal spur, ♀, Luputa, Belgian Congo; *D*, left half of scutellum, and *E*, digitations at outer angle of scutellum, ♀, Djakarta, Java; *F*, abdomen dorsally and ventrally, ♂, Costa Rica, abdominal spiracles numbered 1 to 7; *G*, abdomen dorsally and ventrally, ♀, Nashville, Tenn.; *H*, left antenna from the side, after Jobling (1926); *AA*, antennal appendage; *AF*, antennal furrow; *AP*, antennal pit; *AR*, arista of 3rd segment; *1AS*, *2AS*, and *3AS*, 1st, 2nd, and (hidden) 3rd antennal segments; *I*, distitarsus and claw of hind leg, ♀, Nashville, Tenn. All from domestic pigeon.

An additional case of phoresy of the pigeon-louse, *Columbicola columbae*, was observed in Chicago by R.A. Ward (1953). Brief mention should also be made of Hiragaudar and Khambata's (1954) observation of a *P. canariensis* (reported as *P. maura*) carrying in India a louse of a species of *Brüelia* said to occur normally on Corvidae.

Woke, Jacobs, Jones and Melton (1953) were unsuccessful in experiments to transmit toxoplasmosis of vertebrates, caused by *Toxoplasma gondii* Nicolle and Manceaux, by the bite of *P. canariensis*.

The puparium is easily obtained by keeping pigeon-flies on domestic pigeons in appropriate cages (Huff, 1937). It was first described by Edm. and Et. Sergeant (1907, p. 265, figs. 4-5) and was also mentioned or figured by Helen Adie (1915, p. 672), Drake and Jones (1930, p. 253; Pl. 1, fig. d), Coatney (1931, p. 525), and Bishopp (1942, p. 1074, fig. 2). The following description is based on specimens bred in the Belgian Congo, from flies kept on domestic pigeons, by Dr. J. Rodhain (at Boma) and by Dr. G. Bouvier (at Luputa). The normally developed puparium (Figs. 79C-E) is almost regularly, but broadly elliptical from above, scarcely narrower posteriorly, moderately depressed and almost equally convex dorsally and ventrally, 3 to 3.4 mm. long, 2.4 to 2.8 mm. wide and 1.8 to 2 mm. thick. The polypneustic lobes were described by Newstead (1918, p. 104, fig. 6) from a young adult larva; in a fully-formed puparium they form an almost uniformly convex cap, without indication of radiating ridges or interspaced depressions; the cap is barely hexagonal because of 6 slight sinuities (much shallower than figured by Newstead for the larva), one dorsal, one ventral and 2 on each side. The apex is not appreciably sunken, but bears a median elongate pit and on each side the minute spiracular scar of an earlier larval instar in a very slight depression. (Newstead regards these 2 scars as the single pair of abdominal or anal stigmata and the pores on the polypneustic lobes as "supernumerary stigmata." I am unable to agree with this interpretation.) On the cap itself the minute spiracular pores are arranged in the usual 6 groups, 3 on each lateral half of the cap, each group corresponding to one of the six "slits" on the two stigmal plates of the higher Muscoidea. In *P. canariensis* a single group comprises from 10 to 15 pores, widely spaced, but mostly situated toward the periphery of the cap in an irregular curve. Each pore is set in the center of a small, slightly raised, flat area. The

remainder of the cap is uniformly covered with minute punctures. The surface of the puparium itself is bare, moderately shiny and covered with a microscopic network of very fine engraved lines. I can find no trace of transverse segmentation nor of longitudinal depressions at the sides.

Affinities. As noted elsewhere (1938*d*, p. 43; Part I, p. 296), *P. canariensis* varies greatly in size and tends to average larger on domesticated pigeons than on wild hosts; but some specimens from either type of host are about the same size. On domestic pigeons the wing is 5.8 to 7.5 mm. long (average 6 to 6.5 mm.) and on wild hosts, 4.5 to 6 mm. (average about 5 mm.).

P. canariensis and the Old World *P. rufipes* are so closely related that I am not yet fully satisfied of their specific distinctness. They seem to differ consistently in the shape of the undivided, basal portion of the interantennal area of the frons, which in *rufipes* is much narrower than its shortest distance from an eye and slightly narrower than an antennal pit; whereas in *canariensis* it is about as wide as its shortest distance from an eye and as wide as an antennal pit or wider. There appears to be also a slight difference in the relative length of the 1st and 2nd antennal segments, but it is too subtle to be of much help in diagnosis. The two species are difficult to separate except by direct comparison of specimens and this cannot be done properly from slide mounts. In my earlier papers (1935*a*, p. 396; 1938*d*, p. 43) I mentioned that in *rufipes* the interocular face seemed more nearly parallel-sided, the postvertex slightly longer in proportion to its width, the humeral callosity shorter and broader, and the scutellum relatively narrower and longer than in *canariensis*; but a study of extensive series of flies from domestic pigeons has shown that these differences are too variable to be trusted.

The number, size and shape of the tufted, finger-shaped protuberances at the outer corners of the scutellum (Figs. 78*D-E*) vary greatly in *canariensis* and its 2 congeners, so that it is impossible to use them as specific characters.

In the wing, the bare area in the combined anal, 3rd posterior and axillary cells varies greatly in extent, covering posteriorly from about $\frac{1}{3}$ to $\frac{1}{2}$ of the cell. In addition, there is a longitudinal, discal bare streak, very variable in length and width (usually from $\frac{1}{3}$ to $\frac{1}{2}$ of the width of the cell, occasionally less than $\frac{1}{3}$), in the combined 2nd basal and 2nd posterior cells, as well as a narrow bare streak along the apical portion of the 3rd longitudinal vein in the 1st posterior cell. The apex of the marginal and of

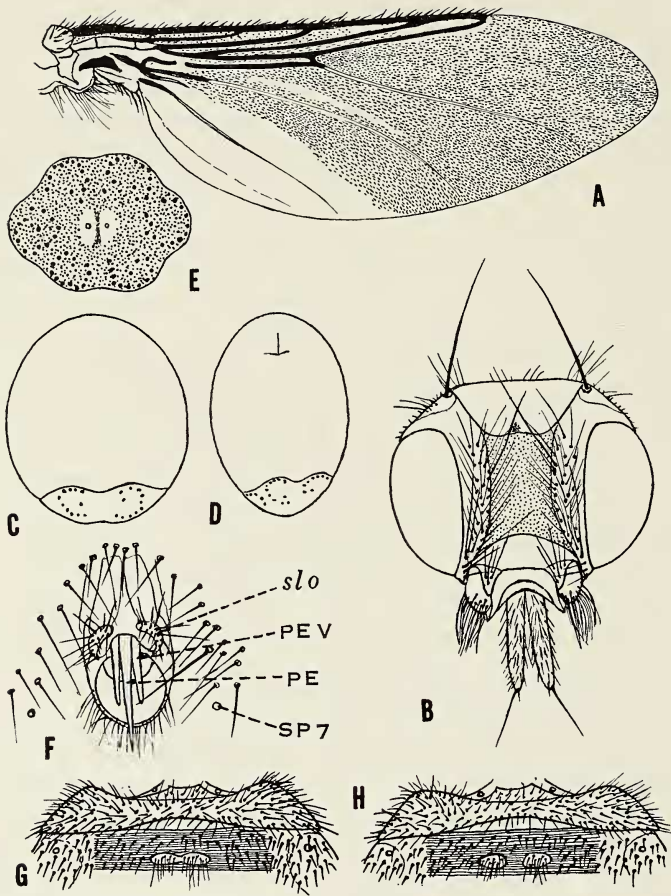


Fig. 79. *Pseudolynchia canariensis* (Macquart). **A**, wing, ♀, Djakarta, Java; **B**, head, ♀, Baragua, Cuba; **C-E**, puparium, Luputa, Belgian Congo, from above (**C**), in side view (**D**), and respiratory lobes (**E**); **F**, ♂ terminalia, Costa Rica: *PE*, penis; *PEV*, penis valves; *slo*, setigerous lobes at side of genital atrium; *SP7*, 7th abdominal spiracle; **G-H**, dorsal basal area of abdomen, ♀: **G**, San Antonio, Tex.; **H**, New York City. All from domestic pigeon.

the submarginal cells, and the base of the 1st basal and of the combined 2nd basal and 2nd posterior cells are also bare. In the costal and subcostal cells, the microtrichia are extremely minute, often barely visible even with a high magnification. The venation is on the whole stable. The subcosta is almost invariably complete, ending in the costa. This is the case in both wings of 106 specimens examined, of both sexes from a variety of hosts and from many localities the world over. The only exception found was a ♂ from Havana, Cuba, in which the subcosta is complete in the right wing, while in the left wing it ends distinctly in the membrane some distance from the costa.

The size and shape of the metasternal spurs are also somewhat variable in *P. canariensis* (Figs. 78A-C). They do not differ much from those of *P. brunnea*; but in *P. rufipes* they appear to be relatively shorter, wider and blunter.

There are some interesting secondary sexual characters, in addition to those of the terminalia. The anterior median sclerite, differentiated in both sexes in the dorsal striolate area of the abdomen, varies much in shape and somewhat in size. In most flies I have seen it is a single, small, transversely elliptical plate, only slightly or not shortened in the middle (Figs. 78F-G). Occasionally it is emarginate medially, anteriorly, posteriorly or at both margins (Fig. 79G), sometimes almost divided into two narrowly connected halves. In a few flies the median connection is severed, leaving a pair of much smaller plates (Fig. 79H). The ♂ has, in addition to this anterior, single or duplicate sclerite, a pair of small posterior plates, lacking in the ♀, placed farther back, nearer the preapical tergite (Fig. 78F'); they also vary in size and in some cases are poorly defined. These median anterior and posterior sclerites bear several setae, somewhat finer and closer together than those of the surrounding striolate area.

The short, stout, black setae on the under (or plantar) surface of the basitarsus of the mid legs, described by Ferris (1925a, p. 417, fig. 3b) for a ♂ from the Philippines, are a sexual character present in the ♂ and absent in the ♀ of both *P. canariensis* and *P. rufipes*. According to Schuurmans Stekhoven, Silva and San Ramon (1954, pp. 393-394) there are also some very slight sexual differences in the apical setae of the tarsal segments and tibiae. On the fore legs, the 2nd and 3rd tarsal segments have 1 seta in the ♀, none in the ♂; on the mid legs, the 1st tarsal segment has 2 setae in the ♀, 5 (in groups of 2 and 3) in the ♂. The

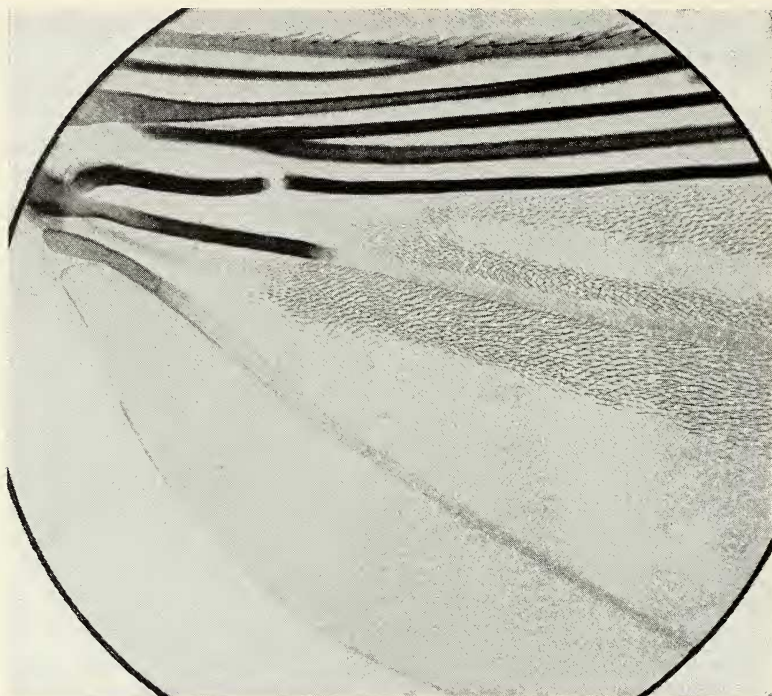


Fig. 80. *Pseudolynchia canariensis* (Macquart), basal area of wing, ♀, Jacksonville, Fla., on domestic pigeon. Photograph by Mr. K. MacArthur (1948, fig. 255).

hind tibiae end in 5 setae in both sexes, but in the ♀ they are in 2 groups (of 2 and 3) and in the ♂ they form a single group.

The unusual variation of many structural characters in *P. canariensis* may have been induced indirectly by the domestication of the host on which most specimens are collected. As is well known, the rock pigeon itself is tremendously variable under domestication.

Original description of *O. canariensis* (French text translated): "Picea. Facie, palpis pedibusque flavicantibus. Length $2\frac{1}{4}$ lines [French lines = about 5.1 mm.]. Setae of the proboscis curved, yellow, twice the length of the palpi. Palpi brownish-yellow, with black apex. Antennae with black, thick, curved setae. Face and anterior portion of frons yellowish; posterior portion brown. Thorax pitch-black. Abdomen dark. Legs dirty greenish-yellow; hind tarsi brownish. Wings yellowish-gray." The type, labelled in Macquart's handwriting, is a ♂ at the Paris Museum, where I studied it in 1951. It agrees in every respect with Bigot's *Olferisia maura*, the common fly of domestic pigeons.

Original description of *O. testacea* (French text translated): "Testacea. Pedibus ferrugineis. Alis pallidis. Length 2 lines [French lines = 4.5 mm.]. Brownish-testaceous. Palpi ferruginous. Face fulvous. Frons brown. Humeri

ferruginous, more prominent and more pointed than in the other species. Abdomen brown. Legs rather pale ferruginous. Wings rather transparent." The description is worthless and the figure of the wing erroneous. Fortunately the two types, labelled by Macquart, are at the Paris Museum, where I saw them in 1951. Although in such poor condition that the sex could not be determined, they are definitely recognizable as *Pseudolynchia canariensis*. Macquart's figure shows a closed 2nd basal cell, but this is not present in the types. Macquart's citation "*Nob. S. à B.*," obviously refers to his earlier "*Suites à Buffon*" (1835); but *O. testacea* is not mentioned in that work.

Original description of *O. maura* (French text translated): "Long. 5½ mm. Antennis castaneis, flavido setosis; epistomate et vertice testaceis, fronte fusca, utrinque nitida; thorace fusco nigro, vix nitente, humeris scutelloque sordide fulvis; abdomine obscure infuscato, segmento 2° apice fulvo marginato; pedibus testaceis, femoribus superne parum infuscatis, nigro parce setosis, posticis, externe, linea tenue, fuscana, notatis; alis fere hyalinis, venis, costali, longitudinalibus 1-4^{is}, omnino, 5^a, usque ad transversam 1^{am} nigram, nigro tinctis. Antennae brown, with yellowish setae; epistome [frons] and vertex [postvertex] broadly shiny yellowish; frons [face] dull brown, with shiny sides [inner orbits]; thorax a rather shiny brown, humeri yellowish, sides and scutellum pale russet; scutellum with 2 lateral setae; sternum russet; abdomen brown, 2nd segment with a narrow yellow margin; legs testaceous, with some black setae on femora, which are slightly brownish above; hind femora with a very fine, outer brown line; hind tarsi brownish beneath; wings very pale yellowish; costa, 1st, 2nd, 3rd and 4th longitudinals wholly, the 5th as far as the 1st cross-vein, the outer vein, and the 6th at base, blackish; 1st cross-vein of the same color, the 2nd very pale; two basal cells very unequal; 2nd longitudinal vein reaching costa rather far from 1st, namely opposite outer cross-vein." The two types are now in the J.E. Collin Collection. Through an oversight I failed to see them in 1951, when I examined the other Bigot types; but Mr. Collin kindly informs me that they are both ♀ and that the wings are 7 mm. long in one and 7.5 mm. in the other. They were seen by Speiser (1902), who stated that *maura* was very close to his *inornata*, but differed in "the darker color of the vertex [postvertex] and the head being more sparsely setose," while the thorax was equally setose in both. These differences are, in my opinion, too slight to be reliable as specific characters. Moreover, I consider *maura* as identical with *canariensis* Macquart.

Original description of *O. lividicolor* (French text translated): "Long. 5 mm. Antennis fuscis; fronte fuscana; oculis castaneis; epistomate sordide flavido; thorace piceo, parum nitente, humeris et scutello obscure fulvis; abdomine, sordido, fulvo opaco; pedibus pallide fulvidis; alis parum infuscatis, venis, costali, longitudinalibus 1-4^{is}, omnino, 4^a, usque ad transversam 1^{am} fuscam, infuscatis, transversa 2^a pallidissima. Antennae brownish, with brown setae; eyes chestnut; epistome [frons] a rather shiny dark yellowish, as are also vertex [postvertex] and inner margin of orbits; thorax pitch-colored, not very shiny; sides and scutellum indistinctly russet; scutellum with two lateral black macrochaetae; abdomen dark brownish-fulvous; legs dirty-yellowish with some brownish setae; wings very pale yellowish; costa, 1st to 4th longitudinal veins wholly, 5th as far as 1st cross-vein, 6th basally, and 1st (outer) cross-vein, brown; 2nd (inner) cross-vein very pale. First longitudinal vein (of Rondani) reaching costa far from 2nd, which stops a short distance before the level of 1st cross-vein; two basal cells very unequal." The type is a ♀ now in the J.E. Collin Collection, where I studied it in 1951. It agrees in every respect with the common pigeon-fly, *P. canariensis*. It should be stressed that, contrary to what might be gathered from Bigot's description, there is only one cross-vein in the wing, so that the statement about the two basal cells being unequal is meaningless. Speiser (1902) also examined this type and recognized its similarity to the other "species" of his *Lynchia* [= *Pseudolynchia*], but thought that it might be separated by "the brownish instead of milky color of the

wings," a character scarcely of specific value in this genus. He later (1908) suggested, however, that it might be identical with *maura* (= *canariensis*).

Original description of *O. capensis* (French text translated): "♂ Long. 5 mm. Cinereo livido obscuro; labro testaceo; palpis pallide fuscis; fronte lata, quadrata, obscure cinerea; alis pallide cinereis, venis externis parum infuscatis, transversali fusca, ad apicem primae longitudinalis haud extra nec infra locata; oculis nigris. Of a grayish, indistinctly livid tinge; frons [face] square, dark gray, without lines or grooves; labrum [frons] testaceous; palpi long, brownish; abdomen slightly tinged with brown; wings much lengthened, pale gray; outer veins brown; the cross-vein darker, placed exactly opposite tip of 1st longitudinal vein; eyes blackish; antennae very small, brownish." The J.E. Collin Collection contains 3 specimens labelled *O. capensis* and one of these is the ♂ type, since Bigot definitely states that his description was based on one specimen. All 3 specimens are labelled "Cap. Bon. Spei" and are *Pseudolynchia canariensis*, according to my study of them in 1951. They were also seen by Speiser (1902).

Original description of *O. exornata* (translated from the German): "Length of dry specimen, 5 mm.; of wing, 6 mm. Head yellowish-brown; antennae with black setae; on the ledges at the inner eye margin [inner orbits] with fine, yellow setulae, which are arranged on each side in two lines, the outer, thinner line being reflected over eye margin and the inner line over vertex [mediovortex]. Thorax black, with a fine, shiny white median line [median notal suture], which does not continue onto scutellum; limit between prescutum and scutum [transverse mesonotal suture] also shiny white, somewhat wider than median line, to which it is perpendicular, with only a slight posteriorly directed curve in the middle. Humeral callosities fairly pointed, yellowish-brown, as are also episterna of mesothorax. Hind margin of mesothorax curved, arched toward surface of thorax (as usual in Hippoboscidae), densely covered with long, fine, yellow setae, which spread like a fan over entire mesonotum and reach scutellum. Scutellum short, as it were truncate, 4 times as wide as long, brown, with very few short setulae. The abdomen cannot be described in detail because of the state of preservation; first segment brown, others blackish; several longer, black setae before apical notch. Legs without peculiarities, brown; base of femora paler; hind legs more blackish-brown. Wings slightly clouded with gray; venation exactly as in *Olfersia ardeae* Meq. [= *Lynchia albipennis* Say]." In 1902, Speiser placed his *exornata* more correctly with *maura* in *Lynchia*, the name he used for what is now called *Pseudolynchia*. I studied the type at the Genoa Museum in 1951 and recognized that it is a ♀ of the pigeon-fly. I was unable to find a reliable character separating it from *P. canariensis*.

Original description of *L. simillima* (translated from the German): "Length, 4 mm.; from margin of mouth to margin of scutellum, 3 mm. Differs from *L. exornata* Speiser and related species in yellowish-brown color of thorax; very similar to *L. capensis* Big., from which it differs in the following characters of the vertical triangle [postvertex]: anterior emargination of this triangle not filled in with white and only hind margin with a whitish-yellow border. Head and thorax umber-brown; head with bone-yellow hind margin; thorax with somewhat paler humeral angles; scutellum and longitudinal suture [median notal suture] also paler. Clypeus [frons] short, scarcely $\frac{1}{3}$ of length of remainder of head, its apical edges only slightly produced, itself only a trifle paler than rest of head. Maxillary palpi only very slightly curved. Wings with a very weak whitish cloud; venation without peculiarities. Legs and abdomen without special features." This description was based on a specimen originally referred rather doubtfully to *Olfersia spinifera* by van der Wulp (1880), with the following notes (translated from the Dutch): "What Wiedemann and Schiner say of the so-called "thorn" on the thorax anteriorly [humeral callosities], applies entirely to my specimen. However, I do not see the two deep transverse grooves on the frons [face] which Schiner mentions;

the frons [face] is on the whole somewhat depressed medially [mediovertex] and somewhat raised and also more shiny on the sides [inner orbits]. Furthermore, Schiner calls the face produced as a cone; I do not quite understand what he means by this, unless he refers to the sides of the face below the eyes, which are somewhat triangular in profile. Moreover, in my specimen the head and thorax are covered with a thick, yellowish, flattened pilosity; the sides of the thorax, the hind margin of the scutellum and the tip of the abdomen bear black setae. The femora and tibiae of the brownish-yellow legs are translucent. What makes me suspect that this may be a different species from the one mentioned by Schiner is especially that he calls the anal cell (the lower basal cell) of the wings short but distinct; for in my specimen, which shows the venation distinctly, the anal cell is actually lacking, because the cross-vein which should close it on the outer side is missing." It should be noted that van der Wulp misunderstood Schiner's term "untere Basalzelle," which refers to the closed 2nd basal cell (present in *Olfersia* and *Lynchia*, absent in *Pseudolynchia*), not to the anal cell (absent in all 3 genera). In 1951 I studied this specimen at Amsterdam in the de Meijere Collection now in the care of the Netherlands Entomological Society. It is labelled "*simillima*" in Speiser's handwriting, although not marked as a type. I was unable to find that it differed in any respect from the usual *Pseudolynchia canariensis*, a common parasite of domestic pigeons in Java (specimens seen from Batavia [Djakarta], Sukabumi, and Bandung in Preanger).

Original description of *O. garzettæ*: "Nigricante picea, abdominis lateribus pallidiusculis; fronte, proboscide, antennis, maculis humeralibus, et linea basale scutelli sub-testaceis. Alae fuscescentes, vena transversa anteriore deficiente: longitudinale tertia costali conjuncta paulo magis longe a quarta quam a secunda. Pedes omnes et toti fusco-obscuri, unicolores." No measurements are given. Rondani's genus *Olfersia* comprised Italian species without closed anal cell [Rondani's areola axillaris]. He divided them into those with a closed 2nd basal cell ("Vena transversa interior quamvis abbreviata semper distincta"), now placed in *Lynchia*, and those without such a cell ("Vena transversa interior omnino nulla"), now placed in *Pseudolynchia* and *Microlynchia*. His *garzettæ* and *falcinelli* are both included in the second group and are separated on the basis of the color of the wings ("fuscae" for *garzettæ*; "sub-limpidae" for *falcinelli*) and of the legs ("toti obscure fuscescentes" for *garzettæ*; "sordide lutescentes" for *falcinelli*). According to Dr. B. Lanza (*in litt.*, 1953), the types of both *garzettæ* and *falcinelli* are in Rondani's Collection, now at the Florence Museum. They do not appear to have been studied by any later author. Speiser (1902) included *garzettæ* in *Lynchia*, the name he used for *Pseudolynchia*, and he later referred to it a specimen from Bavaria; but he does not state how he arrived at this identification. However, a ♂ from Genoa, taken on *Circaëtus gallicus*, which I saw at the Genoa Museum, had been named "*Lynchia garzettæ* Rondani" by Speiser. This specimen is not separable from *Pseudolynchia canariensis* (Macquart). As Rondani's description agrees well with *P. canariensis* and as none of his other descriptions can be definitely referred to the pigeon-fly, which is common in Italy, it is practically certain that *garzettæ* was based on this insect. The specific name is meaningless, since Rondani states explicitly that the host of his fly was unknown. Bau (1929) also determined 3 flies in the v. Röder Collection, from Greece, as *Lynchia garzettæ*, but gave no reasons for doing so.

Pseudolynchia brunnea (Latreille)

Figs. 81A-F and 82

Ornithomyia brunnea Latreille, 1812, in Olivier, Encyclop. Méthod., Insectes, 8, pt. 2, p. 544 (no sex; no host. "Carolina" [probably South Carolina and possibly near Charleston; see below]. Type probably lost). Osten Sacken, 1858, Cat. Dipt. North America, p. 86.

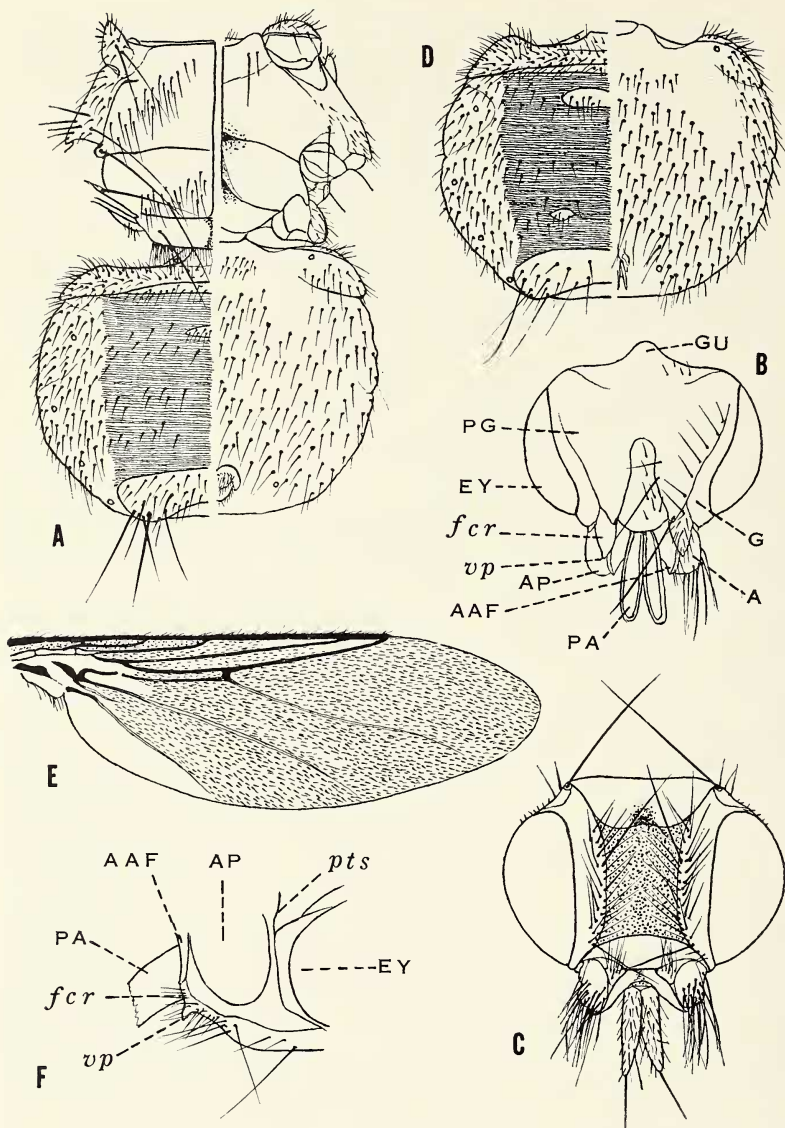


Fig. 81. *Pseudolynchia brunnea* (Latreille). A-C, ♀, Royal Palm State Park, Fla., on *Caprimulgus carolinensis*: A, thorax and abdomen dorsally and ventrally; B, head from behind: A, antenna; AAF, apical arm of frons; AP, antennal pit; EY, eye; fcr, facial ridge; G, gena; GU, gula; PA, palpus; PG, postgena; vp, vibrissal protuberance; C, head in front view; D, abdomen dorsally and ventrally, ♂, Eau Gallie, Fla., on *Chordeiles minor chapmani*;

- Olfersia brunnea* Osten Sacken, 1878, *Smithson. Misc. Coll.*, No. 270, p. 213. Howard, 1883, *South Carolina, Resources and Population*, p. 275. Aldrich, 1905, *Smithson. Misc. Coll.*, 46, No. 1444, p. 655. Washburn, 1905, *Univ. Minnesota, Agric. Expt. Sta., Bull.* 93, p. 163 (Minnesota: on *Chordeiles m. minor*).
- Lynchia* (?) *brunnea* Speiser, 1904, *Ann. Mus. Nat. Hungarici*, 2, p. 388; 1907, *Ent. News*, 18, p. 104. Speiser, 1908, *Zeitschr. Wiss. Insektenbiol.*, 4, p. 304.
- Pseudolynchia brunnea* J. Bequaert, 1926, *Psyche*, 32, (for 1925), pp. 271 and 276. Falcioz, 1930, *Encyclop. Entom., Sér. B, Diptera*, 5, (for 1929), p. 49 (Mexico. Argentina). J. Bequaert, 1935, *Rev. Zool. Bot. Afric.*, 27, pp. 395 and 396, fig. 1C. Peters, 1936, *Bird-Banding*, 7, p. 18 (Ohio: on *Chordeiles m. minor*). Brimley, 1938, *Insects North Carolina*, p. 390 (North Carolina: Raleigh). J. Bequaert, 1938, *Ent. News*, 49, p. 42; 1940, *Mem. Soc. Cubana Hist. Nat.*, 14, No. 4, p. 324; 1940, *Rev. Acad. Colombiana Cienc. Ex. Fis. Nat.*, 3, No. 12, p. 416. Essig, 1942, *College Entomology*, p. 815. MacArthur, 1948, *Bull. Publ. Mus. Milwaukee*, 8, pt. 4, pp. 426 and 427, fig. 254 (Minnesota: without precise locality, on *Chordeiles m. minor*). Swain, 1948, *The Insect Guide*, p. 214, fig. 174b. Herms, 1950, *Medical Entomology*, 4th Ed., p. 414.
- Lynchia maura* Knab, 1916, *Insecutor Inseclitae Menstruus*, 4, p. 3 (in part: specimen from Ames, Iowa, only). Not of Bigot, 1885.
- Pseudolynchia* sp. Travassos and Teixeira de Freitas, 1941, *Mem. Inst. Osw. Cruz*, 35, (for 1940), pt. 3, p. 542 (Brazil: Salobra, State Matto Grosso, on *Nyctidromus albicollis derbyanus*).

Distribution and Specimens Examined. DOMINION OF CANADA.

ONTARIO: Low Bush, Lake Abitibi, on *Chordeiles m. minor*, July 22 (N.K. Bigelow).

UNITED STATES. ARKANSAS: Hot Springs, Yavapai Co., 8 ♀ ♂ on *Caprimulgus v. vociferus*, May 5 (R. Dahm). — FLORIDA: Princeton, Dade Co., 11 specimens on a dying *Caprimulgus v. vociferus*, Feb. 25 (W. Byrd); Royal Palm State Park, Dade Co., on *Caprimulgus carolinensis*, Oct. 22 (C.A. Mosier); Eau Gallie, Brevard Co., on *Chordeiles minor chapmani*, May 5 (W.W. Worthington); St. Vincent I., Franklin Co., on *Caprimulgus carolinensis*, Nov. 1 (W.M. McAtee); Munroe Co., on *Caprimulgus carolinensis* (D.J. Nicholson); St. Augustine, St. Johns Co., on *Caprimulgus carolinensis* (C.W. Johnson). — GEORGIA: [Neel Gap or Frogtown Gap, Union Co. — P.W. Fattig, *in litt.*; not seen]. — IOWA (recorded by Knab, 1916, by error as *Lynchia maura*): Ames, Story Co. (Knab's specimen). — KANSAS: Kansas City, Wyandotte Co., on *Chordeiles m. minor* (S.R. McLane). — MARYLAND: Leeland, Prince Georges Co., Aug. 26, on *Caprimulgus v. vociferus* (A.B. Howell). — MASSACHUSETTS: Wareham, Plymouth Co., on *Caprimulgus v. vociferus* (O. Bangs); Sherborn, Middlesex Co., on *Caprimulgus v. vociferus*

E, wing, ♀, Santiago de Cuba; **F**, lower anterior edge of head in profile, ♂, Orient, N.Y., on *Chordeiles m. minor*: **AAF**, apical arm of frons; **AP**, antennal pit; **EY**, eye; **fer**, facial ridge; **pts**, ptilinal suture; **vp**, vibrissal protuberance; **P4**, palp.

ENTOMOLOGICA AMERICANA

(C.W. Johnson). — MICHIGAN: Long Point, Monroe Co., on *Hylocichla fuscescens salicicola*, May 9 (P. Brodkorb). — MINNESOTA (recorded by Washburn, 1905; MacArthur, 1948): without precise locality, on *Chordeiles m. minor*, June 2. — NEW MEXICO: Alamogordo, Otero Co., May 7. — NEW YORK: Orient, Long Island, on *Chordeiles m. minor*, May 30 (Roy Latham). — NORTH CAROLINA (recorded by Brimley, 1938): Raleigh, Wake Co., (H.H. Brimley). — OHIO (recorded by Peters, 1936): Adams Co., on *Caprimulgus carolinensis* (M. Trautman). — SOUTH CAROLINA (recorded by Latreille, 1812). — TENNESSEE: Nashville, Davidson Co. (Mrs. A.R. Laskey). — TEXAS: 20 miles S.W. of Eagle Lake, Colorado Co., on *Caprimulgus carolinensis*; [Camp Bullis near San Antonio, Bexar Co., on *Caprimulgus carolinensis* and *Phalaenoptilus n. nuttalli*. — J.M. Brennan, *in litt.*; not seen]. — VIRGINIA: Hot Springs, Bath Co., on *Caprimulgus v. vociferus* (W. Robinson).

MEXICO (recorded by Falcoz, 1930): without more definite locality (A. Sallé); Arriaga, State Chiapas, May 24 (P. Brodkorb).

PANAMA: Barro Colorado, C.Z., on *Chordeiles a. acutipennis* (R.C. Shannon).

ANTILLES. CUBA: Santiago de Cuba, Prov. Oriente.

BRAZIL (recorded by Travassos and Teixeira de Freitas, 1941): Matto Grosso, on nighthawk (R.C. Shannon); Ypiranga, State São Paulo, on *Chordeiles m. minor* (J. Lima); Salobra, State Matto Grosso, on *Nyctidromus albicollis derbyanus* (Inst.Osw.Cruz. — Recorded by Travassos and Teixeira de Freitas, 1941, as *Pseudolynchia* sp.); Rio de Janeiro, D.F., on *Hydropsalis b. brasiliiana* (A. Diniz); Botucatu, State São Paulo, on *Nyctidromus albicollis derbyanus* (Werner).

ARGENTINA (recorded by Falcoz, 1930): Territorio Río Negro (L. Guttieres); Bariloche, Territorio Río Negro, on nighthawk, Nov. (R.C. and E. Shannon); Icano, Santiago del Estero (E.R. Wagner); Tucumán, on juvenile *Setopagis p. parvula*, Apr. 5 (K.J. Hayward).

P. brunnea is restricted to America, where it is probably more common than the available records indicate. Specimens are difficult to collect because of the peculiar habits of the breeding hosts. It seems to occur over most of the temperate and tropical parts of the New World, since it is known from southern Canada (48° 35' N.) to northern Argentina (about 28° S.).

Known Nearectic Hosts of *P. brunnea* (verified individual records in parentheses). Caprimulgiformes (15): *Caprimulgus carolinensis* (5); *C. v. vociferus* (5); *Chordeiles m. minor* (4); *C. minor chapmani* (1); *Phalaenoptilus n. nuttalli*. Passeriformes: *Hylocichla fuscescens salicicola* (1).

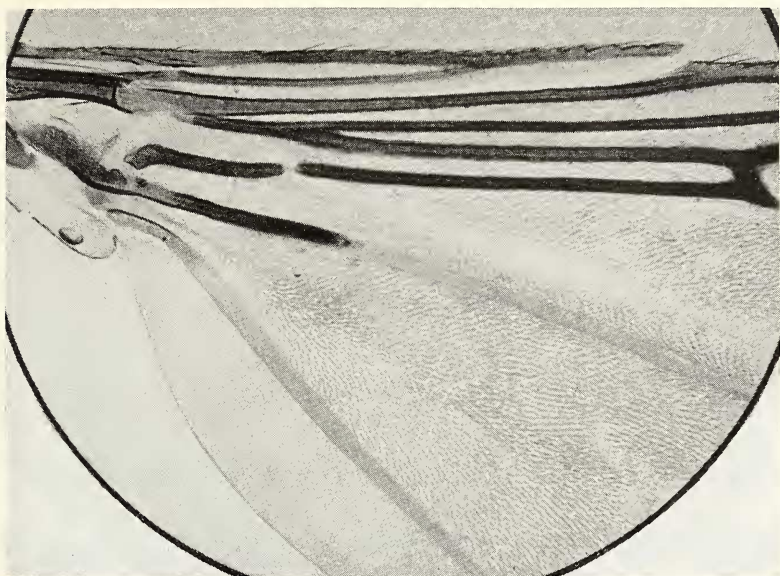


Fig. 82. *Pseudolychnia brunnea* (Latreille), basal area of wing, Minnesota, on *Chordeiles m. minor*. Photograph by Mr. K. MacArthur (1948, fig. 254).

Known Neotropical Hosts of *P. brunnea*. Caprimulgiformes (6 and 2 unnamed nighthawks): *Chordeiles a. acutipennis* (1); *C. m. minor* (1); *Hydropsalis b. brasiliana* (1); *Nyctidromus albicollis derbyanus* (2); *Setopagis p. parvula* (1).

Bionomics. The records leave little doubt that *P. brunnea* is a strictly specific parasite of Caprimulgidae. The one record from a willow thrush is clearly accidental and I suspect due to an error or to *post mortem* contamination. The puparium and other details of the life history are unknown. To the one case of infestation with mites mentioned in Part I (p. 159) may be added a ♂ from Orient, N. Y., on *Chordeiles m. minor*, carrying several mite clusters on the under side of the veins in both wings.

Affinities. The characters given in the key will separate *P. brunnea* from both *P. canariensis* and the Old World *P. rufipes*. The basal portion of the interantennal area of the frons of *brunnea* is decidedly narrower than its shortest distance from an eye (as in *rufipes*); also relatively longer than in *canariensis* and often with a shallow longitudinal groove. The postvertex is short, semi-elliptical, similar to that of *canariensis*, with a deep, sometimes pit-like anterior emargination. The antennae appear to be relatively broader than in *canariensis*. The palpi are distinctly shorter than

the mediovertex. The humeral callosities are slender, longer than wide. Seen from above, the prealar tip of the anepisternum is more pointed than in *canariensis*, though not projecting outwardly. The metasternal tooth is long and narrow, somewhat more slender than in *canariensis*. The striolate median area of the abdomen is almost bare, with an anterior differentiated median sclerite in both sexes and, in the ♂, an additional posterior pair of small sclerites (Figs. 81A and D). The thoracic dorsum and the abdomen are much less setose than in *canariensis*; the orbital bristles also are fewer and more restricted to the inner half of the orbit, though in more than one irregular row.

In the wing, the distribution of the microtrichia is similar to that of *canariensis*, except for the characteristic greater extent in the combined anal, 3rd posterior and axillary cells, which are bare only in the extreme base; in some flies the cell has irregular bare spots toward the axillary vein. The bare streak in the combined 2nd basal and 2nd posterior cells is usually narrow and short, sometimes barely indicated or even lacking. There is no bare streak along the 2nd longitudinal vein. The subcosta is complete in all specimens seen thus far.

Original description of *O. brunnea* (French text translated): "*O. ocellis nullis, corpore brunneo, ore, thoracis angulis anticis pedibusque pallidis; alis subovalibus*. It is 3 [French] lines [= about 6.7 mm.] long from the head to the tip of the wings and a little less if only the body is measured. It is dark-brown, with the mouth, occiput [postvertex], anterior angles of the thorax, sternum and legs pale yellowish. The eyes are dark. The yellow area of the occiput [postvertex] forms a notched spot. The dorsum of the thorax bears yellowish hairs. The scutellum is short, broad, truncate, transverse. The wings are large, nearly ovate, with yellowish veins; those near the costa are darker." The type, collected by L. A. G. Bose d'Antie in one of the Carolinas, is now lost, so far as could be traced. It is not now at the Paris Museum. From 1798 to 1800 Bose resided in the United States, where according to Cuvier (1829, Mém. Mus. Hist. Nat., Paris, 18, p. 82) he spent most of his time studying natural history at the Botanical Garden which André and François-André Michaux had established about 10 miles from Charleston (see R.H. True, 1937, Proc. Amer. Phil. Soc., 78, No. 2, p. 315). It is therefore fairly certain that the type of *brunnea* came from South Carolina, most probably from the vicinity of Charleston. Latreille's description was certainly based on a species of *Pseudolynchia*, as the "short, broad, truncate, transverse scutellum" can only refer to this genus. Since there is no evidence that the pigeon-fly had reached the United States by 1800, *P. brunnea* must have been the specific *Pseudolynchia* of American Caprimulgidae, the only native New World species of the genus. Moreover, if the length given by Latreille was measured with the wings folded over the abdomen, it fits *P. brunnea* better than *P. canariensis* as found on domestic pigeons in America. Osten Sacken (1878) first referred *brunnea* to *Olferisia*, a name used at that time for all hipoboscids with an open anal cell; but it is not known whether he saw a specimen. Speiser (1904) suggested that it might be a *Lynchia* (the name he used for the species now placed in *Pseudolynchia*), but he did not see it.

(To be concluded and indexed in vol. XXXVI)